

HOUSE.....

.....No. 1.

(Part of Table [A.] Omitted.)

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# R E P O R T

OF

## Experiments and Observations

ON THE

CONCORD AND SUDBURY RIVERS,

IN THE YEAR 1861.

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BY COMMISSIONERS

Appointed under Chap. 154, Acts of 1861.

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B O S T O N :

WILLIAM WHITE, PRINTER TO THE STATE.

1 8 6 2 .

Page 2 is blank in the printed report.

The Report with a complete Table A is in the volume, *Legislative Documents*, House 1862, 1-150, shelved in Special Collections, located in the Massachusetts State House basement. The complete A has observations every day, July 27 - October 14, 1861, while the partial table has August 7 - 12 and August 30, 1861. Both have the same days of "Extra" and "General Observations."

Table B, table C, profile, and plan have no page numbers. They were bound between quires of the printed report but in the djvu copy here are added as pp. 125-128, respectively.

Cross-sections, stated on page 31 as annexed, are not present in the printed report nor here in this djvu copy.

The cross-sections are on a 27 x 19" drawing available in Special Collections, *Sections to accompany the report of the commissioners on Concord and Sudbury Rivers*, published 1861, call # Map Mass. 1861, OCLC # esl10122359. The plan and profile are available as larger scale drawings than above, call # Map Mass. 1861, OCLC # esl10122365, and Map Mass. 1861-62, OCLC # ocm31474090, respectively. Also available, *Plan representing the North Billerica dam [map] : with what remains of an old dam*, from notes of the commissioners, published 1862, call # Map Mass. Billerica 1862, OCLC # ocm31854189. A DVD with TIFs, say 1 gb, of the drawings except for the profile can be bought from the Middlesex Canal Association.

The profile uses a zero datum 10.00' below "top of bolt". The bolt was placed in 1825 with its top even with the top of the flashboards. The top is el. 108.6'  $\pm$  0.15', North American Vertical Datum of 1988 (el. 109.4'  $\pm$ , sea level datum of 1929), based on the dam elevation in an October, 2000 survey for a Billerica flood insurance study and the 0.72' flashboard height in the plan of the dam, ocm31854189.

Djvu copy and notes by J. Jeremiah Breen, president, Middlesex Canal Association.

# Commonwealth of Massachusetts.

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EXECUTIVE DEPARTMENT, BOSTON, }  
January 6, 1862. }

*To the Honorable House of Representatives :—*

In obedience to the provisions of section 2 of chapter 154 of the Acts of 1861, I herewith communicate to the General Court the report, tables, and map prepared by Daniel W. Alvord, Charles S. Storow, and J. Herbert Shedd, Esquires, Commissioners appointed under said statute to “make such experiments with the dam across the Concord River at North Billerica, erected by the proprietors of the Middlesex Canal, and the water raised by said dam, as shall be necessary to determine whether said dam affects, and if so, to what extent, the meadows on said Concord and Sudbury Rivers, above said dam ;” and I respectfully recommend that an appropriation be made to compensate said Commissioners for their services and personal expenses, and to cover also the general expenses of said commission.

I have also to inform the General Court that in obedience to a provision of the Act above cited, a warrant was issued in favor of various persons to whom the Commissioners had awarded damages for injuries suffered in consequence of their experiments, and that this warrant being presented at the Treasurer’s Department for payment, was not honored for reasons set forth in a letter of the Treasurer addressed to me on the 4th instant.

I herewith transmit for the information of the General Court a copy of the warrant, and also of the communication of the Treasurer ; and I recommend that the necessary provisions be made to enable the Treasurer to pay these awards.

JOHN A. ANDREW.

## Commonwealth of Massachusetts.

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TREASURER'S OFFICE, BOSTON, {  
January 4, 1862. }

To His Excellency JOHN A. ANDREW, *Governor* :

May it please your Excellency: I have received a warrant upon the treasury, ordering the payment of \$4,378.47 to certain parties named therein, in connection with an Act of the Legislature of 1861, chapter 154, section 4, on "account of Commissioners of Concord and Sudbury meadows," awards of 1861.

No specific appropriation was made by the Legislature for meeting the expenses incident upon the case in point, and although the Supreme Court has decided that when power is conferred upon the Governor by the Legislature to "draw his warrant," that power is equivalent to an appropriation, the Treasurer himself is not in a position to make payment upon such warrant, and the decision would itself seem to override the whole theory of appropriation as specifically set apart by legislative action. All the money in the treasury is devoted to specific objects, by specific appropriations. At present, a part of these appropriations is exhausted; upon others there are unanswered demands; and still more, there are outstanding bills not yet audited, more than enough to exhaust them. Whatever moneys are yet in the treasury consecrated to claims audited and allowed, and drawn for, are a *trust* in the hands of the Treasurer—the property really of the claimants, and only awaiting their call; and it appears to me that I have no authority whatever to take from any one of these appropriations, for the purpose of meeting a demand not recognized by its own specific appropriation, and so impoverishing those that are specifically recognized.

With the highest respect, I remain,  
Your obedient servant,

HENRY K. OLIVER, *Treasurer*.



No. 18.

## COMMONWEALTH OF MASSACHUSETTS.

BY HIS EXCELLENCY THE GOVERNOR.

By and with the advice and consent of the Council, you are ordered and directed to pay unto the Corporation and Persons named on the accompanying Roll, the sum of four thousand three hundred seventy-eight dollars and forty-seven one-hundredths, in conformity to an Act of the Legislature of 1861, (Chap. 154, Sect. 4,) account "Commissioners Concord and Sudbury Meadows, 1861," "Awards," for which this shall be your sufficient warrant.

Given at the Council Chamber, in Boston, the Third day of January, One Thousand Eight Hundred and Sixty-One, and in the Eighty-Sixth year of American Independence.

J. A. ANDREW, *Governor*.

\$4,378.47.

By the Governor, with advice and consent of the Council.

TO THE TREASURER AND RECEIVER-GENERAL.

OLIVER WARNER, *Secretary*.

COUNCIL CHAMBER, JANUARY 3, 1861.

The foregoing Warrant is examined, and found to correspond with the Auditor's Certificate, and the payment to be made under it appears to be just and according to law.

JAMES M. SHUTE, *for the Committee on Warrants*.

JANUARY 1st, 1862.

Hon. LEVI REED, *Auditor, &c.*

DEAR SIR,—The awards to the several parties under statute 1861, chapter 154, are payable from the treasury without any special appropriation for the purpose. The Act itself is in effect an appropriation.

Such was the decision of the Supreme Court in a former case.

Very respectfully, your ob't servant,

DWIGHT FOSTER,

*Attorney-General*.

## COMMONWEALTH OF MASSACHUSETTS.

No. 18.

AUDITOR'S DEPARTMENT.

BOSTON, JANUARY 3d, 1862.

*To His Excellency the Governor, and the Honorable Council.*

There is due to the \_\_\_\_\_ named on the Roll hereunto annexed, the sums set against each, amounting to \$4,378.47 on account of awards made to them by the Commissioners on the Concord and Sudbury Meadows, the

Attorney-General having given his opinion, a copy of which is hereto annexed, that the amount of the awards is appropriated by section 4, chapter 154, of the Acts of 1861.

LEVI REED, *Auditor.*

To be placed to account of Commissioners

Concord and Sudbury Meadows, 1861. Awards.

Belvidere Woollen Manufacturing Company, . . .	\$1,721 76	
Charles P. Talbot, et al., . . . . .	974 19	
James R. Faulkner & Co., . . . . .	1,682 52	
	<u>          </u>	\$4,378 47

ROLL.

	Amount.	Date of Payment.
Belvidere Woollen Manufacturing Company,	\$1,721 76	
Charles P. Talbot, and others, . . . . .	974 19	
James R. Faulkner & Co., . . . . .	1,682 52	
	<u>          </u>	
	\$4,378 47	

## Commonwealth of Massachusetts.

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To His Excellency JOHN A. ANDREW, *Governor of the Commonwealth of Massachusetts:*

The Commissioners appointed under the Act of 1861, chapter 154, to “make such experiments with the dam across the Concord River at North Billerica, erected by the proprietors of the Middlesex Canal, and the water raised by said dam, as shall be necessary to determine whether said dam affects, and if so to what extent, the meadows on said Concord and Sudbury Rivers, above said dam” have attended to the duty assigned them, and respectfully

### REPORT:

The Commissioners met on the 5th day of July last, the parties interested being present by their counsel, and making such suggestions as they saw fit. All parties requested, and the interests alike of the parties and of the Commonwealth seemed to demand, a thorough investigation of the subject committed to us. The Commissioners next made, together, a personal examination of the rivers from the dam at North Billerica to “Beaver Hole Meadow,” in Wayland, a distance by the river of a little more than twenty-five miles. Thereafter some days were consumed in viewing the upper portions of the Sudbury and Assabet Rivers (whose united waters form the Concord), and the more important ponds and reservoirs upon or discharging into these streams. Having determined upon the course of investigation to be pursued, and the number and position of the stations of observation, some time was necessarily consumed in erecting the stations and gathering the men necessary for conducting our experiments. For observers upon

the rivers it was necessary to employ men upon whose accuracy as well as upon their faithfulness and integrity, reliance could be placed. We succeeded in securing the services of a set of observers and assistants, all of whom, we believe, were competent and faithful. On the 27th day of July our arrangements had been completed, the stations were erected, the observers were upon them, and we were ready to proceed with our experiments.

The stations of observation established were thirty-four in number. Of these, thirty from No. 1, at "Beaver Hole Meadow" before mentioned, to No. 30, near the dam at North Billerica, extended in regular succession down the river. The position of each may be seen upon the map herewith submitted. The stations were placed at irregular intervals, at points where some change in the character of the river, some bar, or the vicinity of broad meadows, rendered observations important. No. 31 was upon the Assabet, near the mouth of Nashoba Brook; No. 32 was upon Nashoba Brook; No. 33 was in the Assabet a short distance below the dam at Damon's Mills; and No. 34 was in the Sudbury, at Saxonville, a short distance below the dam there. The last four stations were intended for observations upon the quantity of water poured into the rivers at these points. In order that the bed of the river should not be left dry under any of our stations, during any part of our experiments, most of the stations were so placed in the river that they could be reached only by boats.

It was important for the Commissioners, before disturbing the river by making changes at the dam, to acquire some knowledge of its flow and fluctuations in its ordinary state, in order to have a standard with which to compare its condition under the influence of their experiments. For this purpose observations were commenced at all the stations on July 27th, and continued without interruption until August 7th.

On August 7th, at half-past six o'clock, P. M., the water was drawn down at the dam, and kept as nearly as possible at the height of  $16\frac{1}{2}$  inches below the bolt, which is on the same level with and regulates the height of the upper edge of the flash-boards.

On August 12th, immediately after five, o'clock, A. M., the water at the dam was further drawn down and kept as nearly as

possible at the height of 33 inches below the bolt, being the level referred to in chapter 211 of the Acts of 1860. A great rain, commencing in the evening of August 12th, interfered with and greatly protracted this experiment.

On September 5th, immediately after one o'clock, P. M., the water at the dam was drawn down to the lowest level at which it could be kept, which was 57 inches below the bolt.

On September 6th, immediately after five o'clock, P. M., the water at the dam was again raised to the level of 33 inches below the bolt.

On September 8th, immediately after five o'clock, A. M., all the openings in the dam were closed, and the water was left to rise and regain its ordinary condition, with the dam at its full height.

During all these experiments observations were taken hourly at all the stations from five o'clock, A. M., until nine o'clock, P. M., of each day, except that on Sunday the observations began one hour later and closed one hour earlier than on other days, at some of the stations. All these observations were taken under the constant supervision of the Commissioners.

After the openings in the dam were closed, observations continued to be taken as before until September 16th, at noon, when most of the observers were discharged. At a few important points observations continued to be taken until September 28th. And one or two observers were kept upon the river until late in November.

In October two experiments were tried to test the effect of weeds upon important bars in the river. In November, two experiments, each occupying the space of one day and two nights, were tried for the purpose of testing the accuracy of certain results previously obtained.

While the experiments were going on the river was surveyed, and the several stations were connected by levels, very carefully taken, the general base to which the levels were referred being a point ten feet below the bolt at the dam in North Billerica.\*

Records were kept of the direction and force of the wind, and of the rain fall. There were wind gauges, of an approved pattern, at four stations ; and rain gauges at five stations.

\*The bolt is 115.35 above the Boston base, or mean low water in Boston Harbor.

An investigation was made to determine the effect of the water standing at different levels in the river, during the summer season, upon the different kinds of grasses, and upon other crops.

On each meadow of considerable extent observations were taken at a number of points daily during the whole time occupied by the experiments, for the purpose of testing the effect of the experiments upon the water held in the soil of the meadows.

When the observations were completed, except those taken in November, each Commissioner, being furnished with a full record of all the observations, amounting to upwards of 35,000 in all, examined them by himself, and formed his own conclusions without consultation with the others. And upon all the more important questions upon which opinions are expressed, the three Commissioners came separately to the same conclusions.

Concord River is formed by the junction of the Sudbury and the Assabet. The Sudbury rises in Westborough and runs thence easterly through Ashland to Framingham, and thence in a course a little to the east of north, through the town of Wayland, along the east line of Sudbury and the west line of Lincoln, into Concord, where it joins the Assabet. The Assabet rises in Westborough also, and runs thence in a course nearly north-east through Northborough, Berlin, Marlborough, and Stow, along the line of Sudbury and across a corner of Acton, into Concord, where it joins the Sudbury. From the point of junction near Concord village, the united waters now constituting Concord River flow in a course a little east of north, through Concord, along the line between Bedford and Carlisle, into Billerica to the dam at North Billerica. Thence the river continues in a northerly course until it unites with the Merrimac. The Assabet is, in character, essentially different from the Sudbury and the Concord. With higher banks and greater fall, it is more rapid, is sooner affected by rains or droughts, rises and falls more rapidly. There are no meadows upon it affected by the dam at Billerica, and indeed no meadows of any considerable extent.

The meadows alleged to be injured by the dam in question lie along the Sudbury and the Concord, in irregular bodies, from Wayland to Billerica. They lie now upon the right bank

of the river, now upon the left, now upon both—varying in width from a few rods to about a mile. The greatest expanse of meadows is in the towns of Wayland and Sudbury, but they lie in considerable bodies in Concord, Carlisle, Bedford and Billerica. In their present condition they are very wet throughout their whole extent, and in places they are overflowed during the greater part, if not the whole of the season. The river standing, through the year, nearly full between the banks, there is no possibility of effective drainage, and the meadows can be of but little value for purposes of agriculture. There are in all about 4,000 acres of these wet meadows.

The Sudbury and the Concord constitute in fact but one river, running through a very level country, and with remarkably sluggish waters, for a distance of more than twenty-five miles above the dam in Billerica. A single fact strikingly illustrates the nature of this stream. The bed of the river, for a distance of nearly twenty-five miles above the dam, at no point rises to a level with the top of the dam.

Several circumstances, besides the dam at North Billerica, affect the flow and condition of the river. And of these it is necessary to have a clear understanding, and to keep them constantly in mind, in order fully to understand the results of the experiments.

1st. Like all other streams, this river is, of course, affected by the changes of the seasons. The fall of rain, and the melting of the snows in spring, increase the quantity of water flowing and raise the height of the river surface. On the other hand, evaporation and drought diminish the quantity and lower the surface. These causes act here as elsewhere, modified however somewhat in their operation by causes to be hereafter named.

2d. The river is in some parts of its course exceedingly circuitous, with bends so short and frequent as to obstruct the flow of the water to some extent. \*

3d. About half a mile above the dam and between stations 28 and 29 is a natural bar of hard gravel about 700 feet in length, called the Fordway, and formerly used as a ford. Below this bar the channel is through a broken ledge, and much obstructed by boulders and large rocks, for a distance of about 500 feet. Here the bed of the river is lower than at the



Fordway, but the width of the water way is much less. The bed of the river upon the Fordway is about two feet below the bolt. This bar is a very serious obstruction to the flow of the water. Its effect will be more fully seen hereafter.

About ten miles further up the river, between Stations 21 and 22, is Barrett's Bar, upon which the water is comparatively shallow. About seven miles still further up, between Stations 10 and 11, is Robbins's Bar.

These three bars are all natural and original, not formed by the gradual accumulation of sand, gravel, or other sediment, in the bed of the river, but resulting from the conformation of the surface of the country. Above each is a natural basin, from which the water has worked its way out at the point lowest down the stream, which is now also the point of least elevation in the circumference of the basin. The channel at Robbins's Bar and at Barrett's Bar, may have been, and probably has been narrowed by the accumulation of decayed vegetable matter and other substances on the sides. But there is no reason to suppose that the channel on either bar was ever deeper than it now is. There are several other bars, but the three named are the most important.

4th. During the summer months weeds of different descriptions grow with great luxuriance upon some of the bars, and in other portions of this sluggish stream. In many places they fill the whole channel for long distances, and become so dense and tangled that it is scarcely inaccurate to say that the water oozes or soaks through them as through a sponge. Any effect from above or below is propagated very slowly through these dense masses of weeds. If from any cause the water is lowered below one of these weedy bars, the fall or slope of the water upon the bar is perceptibly increased, and it is a considerable interval of time before the waters above and below the bar resume their former relative levels. And the same effect takes place from any raising of the water above such a bar, unless it is so far raised as to flow over and entirely submerge the weeds, and that to some depth. In the ordinary state of the river there is a fall of the water, or slope, from the top to the bottom of every bar of weeds. In the month of October two experiments were tried to test the effect of weeds upon the water surface. On the 2d and 3d of October the weeds were cut out from a bar between



Stations 4 and 5, called Canal Bar. Before the weeds were cut the fall from the top to the bottom of the bar was 0.18 feet. On cutting out the weeds this slope diminished to 0.05 feet—giving an effect of 0.13 feet due to the weeds. On October 8th, the weeds were cut out of Robbins's Bar, between Stations 10 and 11. The slope upon this bar was reduced from 0.44 feet to 0.10 feet. The fall due to the weeds alone, therefore, was 0.34 feet. Of course, as cutting the weeds could not raise the water at the foot of the bar, the whole effect was produced by reducing the height of the water at the top of the bar. This effect was propagated up stream, diminishing as it went. Two causes lessened the effect as it proceeded: 1st. It met obstructions, as weeds or bends in the stream, and 2d, the water level being reduced, the surface was brought nearer to the bottom, and the section of discharge being decreased, the slope must be increased to give a velocity sufficient to carry the same quantity of water as before through a less space. 0.10 feet of the effect at Robbins's Bar seems to have been lost when the effect reached the head of Canal Bar, leaving 0.24 feet as the effect at Canal Bar of the cutting of weeds at Robbins's Bar. Adding to this 0.13 feet, as the effect of cutting out the weeds of Canal Bar, we have the whole effect of cutting out at both bars 0.37 feet at the top of Canal Bar. This is about  $4\frac{1}{2}$  inches. The weeds were not cut upon any other bar. But by comparing other bars with these, the comparative slope of surface, length of the bar, width and depth of the channel, density of the weeds, &c., a rough estimate may be formed of the effect of the weeds upon them. Forming the best judgment we can in this way, we believe that by cutting out the weeds on all the bars down to and including Barrett's Bar, the water in the river at the great meadows in Wayland and Sudbury may be reduced in height, in the summer season, six inches. We think so much of the height of the water at the great meadows above named is due to the weeds alone.

5th. Artificial causes also affect the flow of the waters and condition of the river. Upon the Assabet there are fifteen ponds and thirty-five mill-ponds, and on the Sudbury there are nine ponds and twenty-three mill-ponds. In some of these the water is stored up in the winter and spring and after rains, and let out gradually when the water would otherwise be low. A

double effect is produced by this. In seasons of the year when the river is naturally full, a portion of the water is held back in the ponds and reservoirs, and the quantity flowing below is less in consequence. But at times, when the river in its natural state would be low, the water being gradually let out from the receptacles where it had been stored, materially increases the quantity flowing below. This cause is sufficient of itself to make a material difference in the height of the river in dry seasons.

6th. But the dams and reservoirs produce still another effect. In the summer months the water is held back by them during the hours of rest, and drawn down during the hours of labor. Of course the quantity of water flowing in the river, on the whole, is neither increased nor diminished by this action. But the quantity passing at given hours of the day, and consequently the height of its surface at such hours, is materially affected. Instead of the average supply which the river delivers per hour being allowed to flow freely each hour of the twenty-four, a much less quantity is allowed to flow during certain hours, and a much larger quantity during other hours. This produces a daily oscillation of the surface, which stands highest when the greatest quantity, and lowest when the least quantity, is passing. An examination upon the Tables annexed to this Report, of the observations made during the twelve days before the experiments at the dam commenced, will illustrate this.

But before making this examination it should be explained that, the general base to which all levels are referred, being a level ten feet below the top of the dam, the height of any recorded surface above the dam may be instantly ascertained by deducting ten feet from such recorded height. Thus if a surface is recorded as standing at 11.26, it is seen at once to be 1.26 above the top of the dam; and so with any other recorded height. Thus by the tables can be seen at a glance not only the relative heights of any points as compared with each other, but their absolute heights above the top of the dam.

At Station No. 1, on Sudbury River, about four miles below the dam at Saxonville, the water, during the days before the experiments commenced, was generally higher in the morning than at night, owing to the fact that it was drawn at Saxonville more freely during the night. The greatest fluctuation at

Station No. 1 during the day, from the highest to the lowest hour was 0.23 feet, or three inches. At No. 2 the fluctuations in the course of a day were less—the greatest variation not exceeding 0.08 feet, or one inch. At Nos. 3 and 4, which are farther removed from the seat of the disturbance, the daily fluctuations were still less. From No. 4 to No. 11, a reach of about five miles, the river remained nearly constant throughout the day. From No. 11 to No. 21 was the region of greatest daily disturbance. No. 17 is in the Sudbury and No. 18 in the Assabet at their confluence. The Assabet is covered with dams and mill-ponds, and is much affected by their management. In general the surface falls during the night and rises from morning till midday—the mills upon the Assabet and its tributary, the Nashoba, being generally stopped at night and worked during the daytime. The greatest fluctuation during any one of the twelve days in question, at No. 18, was 0.31 feet. It usually did not exceed 0.15 feet. The effect of these fluctuations of the Assabet is felt up the Sudbury commonly to Station No. 11, and occasionally as high as No. 7. And they are felt down the Concord commonly to No. 22, and occasionally quite to the dam. Of course the effect is felt less as the stations recede in either direction from the disturbing cause. From No. 22 to No. 27 the river is quite constant in its condition from hour to hour. This is a reach eight and one-half miles in length, carrying the united waters of the Sudbury and the Assabet. The river here is wider and deeper than above, and slight and temporary causes would naturally disturb it less. At Nos. 27 and 28 may be observed, during the twelve days in question, a tendency to follow any changes taking place at the dam below, a lowering at noon and a slight rise during the night. Station No. 30 is close to the dam, so that the observed heights there are in fact the heights of the water at the dam. No. 29 is in the level reach immediately above No. 30, and follows closely all the fluctuations at No. 30. Before the experiments commenced, the fluctuations at Nos. 29 and 30, during the day, did not exceed 0.28 feet. The surface at 5 o'clock, A. M., before the mills started, generally varied but little from that at 9 o'clock of the preceding evening, two or three hours after the mills had stopped.

The river, then, independently of the dam at North Billerica, is affected in its flow and condition by several causes.

1st. By the changes of the seasons.

2d. By the circuitry of its channel.

3d. By the various bars across its channel.

4th. By the growth and accumulation of dense bodies of weeds upon the bars and in other places.

5th. By the holding back of the water in ponds and reservoirs after rains, and the letting it out gradually for mill purposes at other times.

6th. By the holding back of the water in the mill-ponds during the hours of rest, and the allowing it to run in more than natural quantities during the hours of labor.

The cause last named does not operate upon Sunday, when, owing to the cessation of labor at the mills, the whole river is much more constant than on other days.

It is evident that a change of the surface of the river anywhere observed, after the experiments commenced, might be the result of either the 1st, 5th, or 6th cause above named, or of the experiment in progress; and in either case it might be influenced and modified by either of the other causes.

It will be seen hereafter how important it is to take all these various causes into consideration when seeking for results due to one of them alone. Otherwise one might be astounded to read upon the tables the perfectly true record of the fact that the waters opposite and upon the Wayland and Sudbury meadows stood twelve to eighteen inches higher on certain days when the water at the dam was reduced thirty-three inches below the top of the flash-boards, than on other days when it stood at the dam at its full height.

The observations commencing each morning before the mills began to work, and continuing at night until after they had ceased work, by taking for each day the mean of all the observations for that day, a height is obtained which may be considered practically the height of the surface for the day. It probably will not be exactly the true average for all the twenty-four hours, as no observations were taken during the night after nine o'clock. The changes in the river from day to day would affect the surface at all hours, and therefore affect the mean of them all. The mean will therefore exhibit

fairly the effect of the daily changes, while the effect of the hourly oscillations will have been practically eliminated. Such tables, giving the mean height at all points observed upon the stream for each day from July 27th to September 16th, before, during and after the experiments at the dam, have been carefully prepared and are annexed to this Report. (Table "B.")

These Tables are now to be examined, in order to determine the effect of the experiments.

If, in making the examination, days are selected when the quantities of water discharged at the dam are substantially the same, and all the conditions affecting the flow, except the experiments at the dam, are essentially similar, the effect of all other causes affecting the flow will be substantially eliminated, and any difference of level shown by the comparison may be fairly considered as attributable wholly to the remaining cause, the experiment.

But it is very difficult to select days for comparison when the conditions affecting the flow are similar throughout the entire observed length of the stream. It is obvious that the conditions may be the same on the lower reaches of the river, below the mouth of the Assabet, yet widely different above. If on any two days the Sudbury and the Assabet furnish the same quantity to the Concord, and on the same two days the quantities discharged at the dam are the same, the conditions affecting the flow may be safely regarded as practically the same on those two days. But unfortunately these three things rarely concur—never indeed exactly. On any two days the quantity discharged at the dam, and the quantities flowing in the Concord may be the same, yet on one of these days the Sudbury may be yielding more and the Assabet less than its due proportion, and on the other the Assabet may be yielding more and the Sudbury less. On such two days, the conditions below the mouth of the Assabet will be the same, but above, opposite the Wayland and Sudbury meadows the quantity flowing on the one day will be greater than on the other. The differences of level, therefore, above the confluence of the two streams will be owing, in part at least, to other causes besides the experiment at the dam. Or it may chance that on two days the quantities flowing in the upper reaches of the Sudbury are

the same, while the Assabet may be discharging a greater quantity on the one day than on the other. In such case, while the flow of the Sudbury remains the same, the increased discharge of the Assabet, on one of the days, will add to the quantity flowing below its mouth, and will propagate its effect up the Sudbury, until it is lost on Robbins's Bar, or above. Any differences of level therefore on the upper portions of the Sudbury, if any are discovered, may be due wholly to the experiment in progress, while differences of level below the confluence, and also on the lower reach of the Sudbury, may be increased or diminished by the undue discharge from the Assabet.

Bearing these things in mind we will proceed to an examination of the Tables.

During the twelve days from July 27th to August 7th, observations were taken while the river was unaffected by any experiments at the dam. The Tables show that during the latter part of this time there was, besides the daily oscillation, but little irregularity of the surface, and that the changes from day to day were slight and gradual. On the 1st of August there was a fall of rain amounting to about one inch. Its effect is seen in a gentle rise on the 1st and 2nd, which afterwards subsided. The 5th, 6th and 7th of August exhibit a remarkable uniformity of surface. The 7th being the day nearest in point of time to those on which the experiments were made, and that upon which the flow of the river had been steady for the longest period, is the day to be preferred as a standard of comparison with the days succeeding.

During the four following days—the 8th, 9th, 10th and 11th of August—the water at the dam was kept as nearly as possible at the level of  $16\frac{1}{2}$  inches below the bolt and top of the dam. The effect of this is seen in the diminished height of the surface at various points in the river above. There was very little rain-fall during these days, and circumstances seemed to favor the accuracy of the experiment. Table "C" shows fully the difference of level between the surface of the water at the several stations on the 7th of August and on the four succeeding days. The slight rain-fall, occurring at three different times, probably supplied the water lost by evaporation, and the whole fall shown may be safely regarded as due to the



change at the dam. The effect of the Fordway Bar is seen at once. On the 11th of August, four days after the water was drawn down at the dam, and while it stood there 1.44 feet lower than on the 7th of August, it had fallen only 0.66 feet at Station 28, just above the Fordway. From that point the fall gradually diminished from station to station proceeding up the stream, was almost lost on Robbins's Bar, and entirely disappeared at Station 7. Above Station 7 no effect whatever had been produced by drawing down the water at the dam. It is believed by the Commissioners that the whole effect of reducing the height of the dam so as to hold the water there  $16\frac{1}{2}$  inches below the bolt, had been, for all practical and useful purposes, produced upon the 11th of August. There was a slight fall of rain on each of three of these days, to wit, on the 7th, 8th and 10th. On the lower reaches of the river, this apparently no more than counteracted the loss by evaporation. On the upper reaches of the river the rain fall was greater, and it will be seen that on this portion of the river the water was a little higher on the 11th than on the 7th—due probably to the rain. This possibly counteracted somewhat the effect above Robbins's Bar of the drawing down at the dam. But the fall of rain was very slight; it occurred in each instance in the night; all four of the days were bright and hot. While therefore it is possible that absolutely the entire effect of drawing down the water at the dam had not been produced above Robbins's Bar on August 11th, the Commissioners, on careful examination and due consideration of all circumstances and conditions affecting the flow of the river on these days, are fully convinced that no farther effect, sufficient to be practically useful, or valuable for any purpose, could have been produced by such drawing down the water at the dam alone. It is quite probable that but for the dense masses of weeds obstructing the channel of the river, the effect of the drawing down would have been propagated farther up the stream, and would have been greater everywhere above Barrett's Bar. Indeed, the experiments made in November, and hereafter to be more particularly mentioned, seem to prove that this would have been the case.

On the 12th of August, immediately after the observation taken at five o'clock, A. M., greater openings were made in the dam, and the water there was further drawn down. In two

hours, or at seven o'clock, A. M., it had reached the level of thirty-three inches below the top of the dam. It was continued at that level as nearly as possible until September 5th. But in the evening of August 12th, at about nine o'clock, a very heavy rain commenced, continuing through that night, the whole of the next day, and a part of the succeeding night. The rain-gauge recorded a fall during this time of three inches of water. On the 13th, the river began to rise, and continued rising for several days. This of course rendered it impossible to ascertain the effect of this second drawing down of the water at the dam by a comparison of the succeeding days, until the effect had passed off, the rise due to the excessive quantity had subsided, and the river was again discharging about the same quantity as on the 11th.

But between the time when this second drawing down at the dam began, and the time when the rain commenced, was a period of sixteen hours. This period was, of course, wholly unaffected by the rain, nor can we discover during this interval any cause of disturbance on the lower reaches of the river, except the drawing down, nor any thing to prevent the drawing down from producing the whole effect to be expected from it on these reaches within that period of time. At the time of the first drawing down on the 7th of August, a marked effect was seen at Station 28 in half an hour; in three hours one-third of the whole effect had been produced; and in twelve hours one-half of the whole effect had been produced. At the drawing down on the 12th, therefore, if any effect was to be produced by it above the Fordway, as the drawing down commenced at five o'clock, A. M., we ought to have seen some effect at Station 28 by seven o'clock, A. M., a marked effect by nine o'clock, A. M., and before the rain began to fall, at nine o'clock, P. M., half, or more than half, the whole effect to be expected, should have been produced. In fact, neither at seven, A. M., nor at nine, A. M., nor at nine, P. M., had any effect whatever been produced at Station 28, nor at any station on the lower reach of the river. It will be observed that the water at Station 28 stood at exactly the same level at five, A. M. and nine, P. M.

An effect produced by drawing down the water at the dam is seen first at the lower stations, and propagates itself with more



or less rapidity up the stream, being seen later at each successive station as it goes up. If, therefore, in sixteen hours no effect had been produced by this drawing down at any point in the ten miles immediately above the Fordway, none could have been produced at any point higher up the river.

Thus in sixteen hours after the drawing down of the water at the dam on the 12th of August commenced, and fourteen hours after the water there was fully drawn down to the level of thirty-three inches below the top of the dam, with no disturbing cause discoverable to prevent such drawing from producing all the effect to be expected from it in that time, no effect whatever had been produced at any point of the river above the Fordway. If any effect, even a very slight one, had been produced, it might have been doubtful whether in sixteen hours it had reached its limit. But if any effect was to be produced it must have shown itself to some extent within these sixteen hours, and as none whatever was produced above the Fordway within that time, none whatever was likely to show itself afterwards.

In fact the Fordway was now a natural dam, holding the waters above it at a certain level due to its own elevation, and no effect could be produced above it by any further changes in the artificial dam below.

The conclusion is irresistible, that by so changing the dam at North Billerica as to hold the water there at a level  $16\frac{1}{2}$  inches below the present top of the dam, all the effect had been produced upon the waters above the Fordway Bar which could be produced in the then condition of the river by any changes made in the dam alone.

Of course any material diminution of the quantity of water running in the river would further reduce its level above the Fordway; but such change of level would be due to the lessened quantity, not to the change at the dam. The four days commented upon above followed after a long continued period of dry weather, some of which had been exceedingly hot, and the quantity of water then running in the river (there was being discharged at the dam about 100 cubic feet per second), was probably not greater than the ordinary summer flow of the river.

The positions above attained may be further fortified by other arguments drawn from the Tables.

On the 16th of August, when, owing to the great rain which had fallen shortly before, an unusual quantity of water was being discharged at the dam, a boat chanced to get into the principal opening in the dam, obstructing the flow of the water, and causing it to rise in the basin above. It rose to within  $16\frac{3}{4}$  inches of the bolt, without producing any measurable effect at Station 28, or anywhere above the Fordway. The rise to  $16\frac{3}{4}$  inches was at a point of time between the recorded observations, and will not therefore be found upon the Tables. But Table "A" shows the recorded height at Station 30, at five o'clock, P. M., on August 16th, to have been 8.56.

On September 8th, when only about 50 cubic feet of water were being discharged per second at the dam, the water in the basin above was slowly raised, and reached a height of  $16\frac{1}{4}$  inches below the bolt before any measurable effect was produced above the Fordway. From that point, as the water at the dam slowly rose, the level at Station 28 was affected.

The experiments tried in November, when a large quantity of water was running in the river, furnished similar evidence. But more cannot be needed.

The effect of the great rain already mentioned, which commenced on the night following the 12th of August, may be seen by an examination of Table "B." The river rose rapidly at all points from the 13th to the 16th of August, reaching its greatest height on the lower reaches of the river on the 16th, but on the upper reaches not until the 17th. It then began to fall, continuing this until the 30th of August, when the quantity being discharged at the dam was very nearly the same as on the 11th.

During this period, the observations were continued at all the stations. An examination of them may be of interest to any one having leisure for the labor, but they are not of sufficient practical value to require lengthy comment here. They show the state of the river during a period of freshet; and as freshets must always flood the meadows, to a greater or less extent, whether the dam is up or down, these observations are of little value in the present inquiry.

A careful examination of Tables "A" and "B" will show that no day can be found after the great rain, when all the conditions of the river throughout its whole observed length

were substantially similar to those of any day before the rain. There are no two days, one before the rain and one after it, when the quantities discharged by the Concord at the dam, and also the quantities received by that river from both the Sudbury and the Assabet, were substantially the same. On August 30th, the quantity running in the Concord was very nearly the same as on August 7th and August 11th; but a glance at the Tables will show that the quantity running in the Sudbury on the 30th was materially greater than on either the 7th or the 11th. This greater quantity received by the Concord from the Sudbury on the 30th was counteracted in that river by a less quantity received from the Assabet, thus keeping the quantity of the united waters in the Concord the same on these days. But for the purposes of comparison at all stations below the mouth of the Assabet, the conditions of the river on the 7th, 11th and 30th of August, are substantially the same, and a comparison of these days, for the purpose of ascertaining the effect of the drawing down of the water at the dam will be a fair one. Table "C" shows, among other things, such a comparison of August 7th, 11th, and 30th. Table "C," shows also a comparison of these days at the upper stations; but for reasons already explained such a comparison, for stations above the mouth of the Assabet, is not a fair one.

It will be seen that the fall of the surface of the river at all points below Barrett's Bar, from August 7th to August 30th, is very nearly the same as from August 7th to August 11th, the surface standing at all these points on August 30th almost exactly as it stood on August 11th. After August 30th, the quantity being discharged at the dam diminished rapidly, and the slight fall of surface at the lower stations on August 31st and September 1st was doubtless due to this cause.

Again, therefore, we have unmistakable evidence that drawing down the water at the dam 33 inches below the bolt produces no greater effect above the Fordway than drawing it down at the dam  $16\frac{1}{2}$  inches.

It will be noticed that at all stations on the Sudbury above Robbins's Bar, (between Stations 10 and 11,) the surface was materially higher on the 30th of August than on either the 7th or 11th. Of course this effect could not be produced by drawing

down the water at the dam. It was due to the increased quantity running in the Sudbury on the 30th.

Some explanation may be asked as to why it should be that the quantity of water running in the Concord on the 7th, 11th and 30th of August being the same, so much more should be running in the Sudbury on the latter day. It has already been stated that the Assabet was yielding less to the Concord on the 30th than on the former days, and this less quantity was compensated to the Concord by the greater quantity received from the Sudbury. But why should the Sudbury be yielding more and the Assabet less on the 30th than on the 7th and the 11th? Probably it was in part owing to operations at the mills upon the respective streams. But there is another and a natural cause. The Sudbury runs through a very level country, and has wide meadows upon its margins. These meadows are nowhere much above the surface of the river in its ordinary summer condition, and in places are, to the extent of many acres, actually below it, and therefore overflowed. Water received from rains, either directly or by drainage from the higher lands bordering the meadows, is stored on these meadows as in a reservoir, and is thence given out gradually to the river as the latter falls, supplying the quantities taken from the river by evaporation and by its current. The river, therefore, supplied by the water so stored up, falls very slowly. But the Assabet, with greater fall, higher banks, more rapid current and no meadows to supply water to it, runs out its water received from rains rapidly. We should expect, therefore, that the Assabet would fall after a heavy rain much more rapidly than the Sudbury; and we find such to be the case.

The 7th of August, being the last day before the drawing down of the water at the dam commenced, has thus far been selected as the day of comparison with later days at all stations below Barrett's Bar. But other days before the drawing down commenced may be compared with other days after the great rain. On the 7th, the quantity of water running in the Concord was somewhat larger than it had been for a day or two previous, this greater quantity being due to a greater discharge than usual from the Assabet, which in turn received this greater quantity in part from its tributary, the Nashoba. This undue discharge from the Assabet commenced on the night of the 6th.

On the 6th the Assabet was yielding only its usual flow, and the quantity in the Concord was a little less than on the 7th. On the 30th the whole river was falling, and on the 31st the quantity being discharged at the dam was a little less than on the 30th. The quantities running in the Concord on the 6th and 31st of August may be regarded as practically the same, and these days, therefore, may be fairly compared. Such a comparison will be found on Table "C." It will be seen that it substantially confirms the deductions from the previous comparisons. The fall of surface at Station 28, from the 6th to the 31st, is 0.04 feet greater than from the 7th to the 30th; 0.01 feet greater at 26; 0.01 feet greater at 24; and exactly the same at 22.

It has been seen that in a stage of the river corresponding probably with its ordinary summer condition, the fall at the various stations due to drawing down the water at the dam 33 inches is substantially the same as that due to drawing down the water at the dam only 16½ inches. That fall is very nearly 8 inches just above the Fordway Bar near the dam, diminishes as we ascend the stream; slowly on the long level reaches, and more rapidly at any bar or obstruction in the channel; almost disappears at Robbins's Bar, and disappears entirely at Station No. 7.

On September 7th, the last day before the water at the dam was raised to its ordinary height, the water of the Assabet was, for some unexplained reason, held back almost entirely at the mills upon it, so that scarcely any water was received by the Concord from that source. The quantity running in the Concord was therefore much less than on previous days, and the surface of the latter river fell in consequence. At Station 28 the surface fell to the level of 0.94 feet below its ordinary height. The fall this day, diminishing as it went up the river, reached Station 6, where it disappeared.

On September 6th, the water at the dam was drawn down to a level 57 inches below the bolt, and held at that level as nearly as possible for 36 hours. As was to be expected after what we have already seen, no effect whatever was produced above the Fordway by this additional drawing down of the water at the dam. As the river on this day, and for a few days previous, was discharging at the dam much less water than before, the

surface of the river above the Fordway stood at a little lower level than on previous days, but nothing indicated the slightest effect from the drawing down. The only fall above the Fordway was the gradual one from the diminishing quantity, which had been going on for some days, and was neither accelerated nor retarded by the drawing down.

On the 8th of September at five o'clock, A. M., all the openings in the dam were closed, and the water was left to rise to its ordinary level. It rose slowly, and, as has already been seen, no effect was produced anywhere above the Fordway until the water at the dam reached the level of  $16\frac{1}{4}$  inches below the bolt. The Tables show that it took much more time to raise the water than it had taken to lower it. This was owing partly to the diminished quantity flowing in the river at the time of the raising, partly to the use made of the water by the mills at North Billerica as soon as it was high enough for them to use it (one of the mills running day and night for a number of days) and partly to other causes unnecessary to be discussed here. It was not until September 11th that the water ran over the dam, and then only for a short time. It did not run over it again until September 15th. Some comparisons are given in Table "C" of the height of the surface of the water at various stations, on days after the filling up, with the height of the surface at the same stations on days when the water at the dam was down 33 inches. September 15th is thus compared with September 1st, and September 16th with September 2d. These days are selected as, all things being considered, fair ones for comparison on some parts of the river. The morning hours of September 11th are also compared with the morning hours of September 8th. Comments upon these comparisons are unnecessary. It is sufficient to say that they confirm the conclusions already arrived at.

After the 16th of September the observations were continued at only a few important points. They are recorded in Table "A." The water had risen to its ordinary height at the dam, and the dam was no longer interfered with by the Commissioners. Yet up to September 22d the water was steadily falling at all the observed points above Barrett's Bar. On the 22d there was a rain fall of half an inch, causing, as the Tables show, a slight rise in the surface of the river. This rise was however,



greater and more protracted than such a rain would probably produce, and was probably aided by some operations at the mills above.

Two experiments were tried at the dam in November, one on the 2d, 3d, and 4th, and the other on the 9th, 10th and 11th. As before stated, they furnish additional evidence that holding the water at the dam at a level  $16\frac{1}{2}$  inches below the bolt produces as much effect above the Fordway as can be produced by any greater reduction of the height of the dam. These experiments also seemed to prove that the effect of drawing down the water at the dam when the weeds are out, is propagated more rapidly up the river than when the weeds are in, and reaches Farm Bridge in Wayland, above the great meadows. These experiments were not continued long enough to produce their full effect.

The Tables may show fluctuations in the Sudbury upon which no comments have been made. It is believed that they can generally be accounted for by considerations already suggested. Operations at the mills upon the Sudbury and Assabet, and the varying quantities flowing in these streams as compared with each other, furnish a key for the explanation of most of these seeming anomalies. Possibly there may be some fluctuations, which, in our limited knowledge of the laws governing the flow of water, or from overlooking some disturbing cause, it would be impossible fully to explain. All such, however, are believed to be slight and unimportant.

While observations were made at the various stations in the manner before described, other observations were made upon the meadows at Stations 1, 3, 4, 6, 7, 10, 11, 12, 13, 22, 23, 25 and 26, to test the effect of the experiments made at the dam upon the water held upon and in the substance of the meadows. At each of the above stations lines were run across the meadows from the river to the uplands, and at intervals of 300 feet, holes were dug in the meadow, and permanent stakes erected, with gauges attached, by which the height of the water standing in these holes was daily observed and recorded. If the general result of the experiments had been different, showing that drawing down the water at the dam furnished substantial relief to the meadows, these observations upon the meadows might have been of great value. But drawing the

water at the dam failing to furnish substantial relief to the meadows, the observations upon the meadows yielded no results of much value, and it is not deemed necessary to comment upon them. Could the Commissioners have foreseen what the results of the experiments would be, the observations upon the meadows might have been dispensed with.

On August 7th, the last day before the water was drawn down at the dam, the surface of the river opposite the Concord lower meadows, below Barrett's Bar, stood at a level of 0.98 feet below the general surface of the meadows; at the Bedford meadows, on the same day, it stood 0.77 feet below the general surface of the meadows; and at the Carlisle meadows it stood 1.18 below the general surface of the meadows.

On August 11th it stood at the Concord lower meadows 1.52 feet below the general surface of the meadows; at the Bedford meadows, 1.35 feet below; and at the Carlisle meadows, 1.78 below.

On August 30th it stood at Concord lower meadows, 1.54 below the general surface of the meadows; at Bedford meadows, 1.37 below; and at Carlisle meadows, 1.79 below.

At no other point opposite broad meadows, was there any change sufficient to require a comparative statement in this form.

The investigation into the effect of water at different levels in the river, upon grasses and other crops, furnished the following results.

Where the surface of the water, in the ordinary summer condition of the river, stands 0.10 to 0.30 above the general surface of the meadows, pipes grow luxuriantly, mingled with the coarser sedges, including cut grass; and upon hummocks rising above the water, tufts of blue joint are found.

Where the surface of the water was level with the surface of the meadows, the sedges grew, with pipes intermixed and blue joint on the hummocks.

Where the meadow surface was about 0.30 above the water, several varieties of sedges, blue joint, pipes, and a little fowl meadow grass, were found.

Where the meadow surface was 0.50 to 0.70 above the water, the finer sedges, blue joint, cranberries, and sometimes the better grasses, with few pipes, were the common growth.



Where the meadow surface was about one foot above the water, the growth was blue joint, the finer sedges, cranberries, with some fowl meadow, redtop, and herdsgrass.

Where the meadow was 1.60 to 1.90 above the water, the general growth was fine sedges, blue joint, cranberries, with some herdsgrass and redtop.

It remains only to state in proper order the general conclusions of the Commissioners. They are as follows:—

1st. The dam at North Billerica is not the only, nor the chief cause of the wet state of the meadows above. The bars across the stream, especially the Fordway Bar; the weeds filling the channel in many places, often for long distances; the discharge into the river during the summer of water stored in reservoirs and mill-ponds upon the Sudbury and Assabet and their tributaries; in their combined effect, do far more damage to the meadows than the Billerica dam.

2d. Such a change in the dam as shall hold the water there at a level  $16\frac{1}{2}$  inches below the present top of the dam, will, in the ordinary condition of the river, reduce the level of the surface just above the Fordway 8 inches; opposite the Carlisle and Bedford meadows, about 7 inches; at the Concord lower meadows, below Barrett's Bar,  $6\frac{1}{4}$  inches. This effect will diminish as it proceeds thence up the river to Robbins's Bar, where it will substantially disappear. No valuable effect will be produced upon the great meadows in Wayland and Sudbury.

3d. Reducing the height of the dam 33 inches, or removing it altogether, will, in the ordinary summer condition of the river, produce no greater effect anywhere above the Fordway than such a change in the dam as has just been described.

4th. Neither any change which can be made in the height of the dam, nor removing the dam altogether, will, alone, afford substantial relief to the meadows.

5th. Keeping the river clear of weeds will, alone, in the ordinary state of the river, reduce the level of the water surface at the great meadows in Wayland and Sudbury about 6 inches; but this will not afford substantial relief to the meadows.

6th. Removing all obstacles to the flow of the water except the dam at North Billerica, and leaving that dam at its present height, will not substantially relieve the meadows.

7th. So changing the dam as to hold the water there in summer at a level  $16\frac{1}{2}$  inches below the present top of the dam, and thereafter keeping the river clear of weeds, will reduce the level of the water surface as far as Farm Bridge in Wayland, above the great meadows. The effect below Barrett's Bar, being due to the first cause only, will be about as before described. Above Barrett's Bar, the effect, being due to both causes, will be somewhat greater than that before shown as due to either cause alone. At the great meadows in Wayland and Sudbury the water level between the banks will be reduced about 8 inches, possibly a little more—6 inches of this effect being due to the removal of the weeds, and the rest to the change at the dam. The whole effect, however, will not be sufficient to render the meadows fit for cultivation.

8th. The meadows can be effectually relieved only by reducing the height of the dam 33 inches or more; cutting out the Fordway and other bars, and deepening the shallow places in the river, to such an extent that they shall cease to form any obstruction to the free passage of the water in the ordinary condition of the river; straitening the channel in a few places; and thereafter keeping the river free from weeds. In this way the meadows may be so relieved as to become fit for cultivation and valuable.

There are annexed to this Report, Tables and other matters, as follows:—

“A.” A Table of the hourly observations taken at all the Stations from July 27th to the time in November when observations ceased.

“B.” A Table of the means of the observations of each day at all the Stations from No. 1 to No. 30, inclusive, during the same period. The record of the rain-fall will be found upon the margin of this table.

“C.” Tables of the mean heights on certain days, selected and arranged for comparison of one day with another.

“D.” Table of the mean heights observed for each day, from September 17th to October 14th, inclusive, including the days when the weeds were cut on Canal Bar and Robbins's Bar.

“ E.” Table of mean heights, showing that the river was not materially affected above Robbins’s Bar by drawing down or raising the water at the dam, while the weeds remained in the river.

“ F.” Heights of the principal meadows.

“ G.” Table of distances.

“ H.” Tables of rain-fall.

Cross sections of the river ;

Profiles of the surface of the river on sundry days, with a profile of the bed of the river ; and

A map of the river and the meadows, from Saxonville to the dam at North Billerica, accompany this Report.

All which is respectfully submitted.

D. W. ALVORD,  
CHAS. S. STORROW,  
J. HERBERT SHEDD,

*Commissioners.*

## EXPENSES OF THE COMMISSION.

Compensation of three Commissioners for labor from July 5th to December 13th inclusive, . . . . .	\$4,000 00
Personal expenses of the Commissioners, as by Schedules 1, 2, 3, hereunto annexed, viz.:—	
1. Personal expenses of D. W. Alvord, . . . . .	122 98
2. “ “ Charles S. Storrow, . . . . .	88 45
3. “ “ J. Herbert Shedd, . . . . .	82 78
General expenses of the Commission, as by Schedule 4, hereunto annexed, . . . . .	10,057 82
	<hr/>
	\$14,352 03
Deduct amounts heretofore received, credited on Schedule 4, and applied on said general expenses, as by amounts here- tofore rendered, . . . . .	2,556 49
	<hr/>
	\$11,795 54

## SCHEDULE No. 1.

*Personal Expenses of D. W. ALVORD, Commissioner.*

July	4.	Fare to Boston from Greenfield,	\$3 25
		Hack hire—both places,	. 60
	8.	Fare from Boston to Lowell,	. 75
	9.	Bill in Lowell,	. 1 00
		Fare, Lowell to North Billerica,	1 00
	10.	Bill at Framingham,	. 75
		Fare, Framingham to Boston,	. 65
	16.	Fare from Boston to Concord,	. 60
		Dinner in Concord,	. 67
		Fare from Concord to Boston,	. 60
	17.	Fare, Boston to Westborough,	. 90
		Dinner in Marlborough,	. 50
		Fare back to Boston,	. 90
	23.	Bill at Parker House, parts of 19 days,	27 75
		Fare from Boston to Green- field, and hack hire,	3 60
	30.	Fare from Greenfield to Bos- ton, and hack hire,	3 60
Aug.	1.	Fare from Boston to Waltham,	. 25
		Fare back to Boston,	. 25
	3.	Fare to Concord and back,	. 1 20
	6.	Bill at Parker House, 7 days,	16 21
		Fare from Boston to Concord,	. 60
	12.	Fare from Concord to Green- field, and hack,	3 00
	22.	Fare from Greenfield to Con- cord, and hack,	3 00
	26.	Fare from Concord to Boston, Paid Paper, &c.,	60 1 00
		Carried up,	\$73 23
		Brought up,	\$73 23
Aug.	27.	Bill at Parker's, 2 days,	2 50
		Fare from Concord to Boston,	. 60
	31.	Fare from Concord to Boston and back,	1 20
		Fare from Boston to Cambridge and back,	20
		Dinner in Boston,	. 75
Sept.	5.	Fare from Concord to Boston and back,	1 20
		Dinner in Boston,	. 80
	7.	Fare from Concord to Green- field, and hack hire,	3 00
	24.	Fare, Greenfield to Concord,	. 2 85
		Fare from Concord to Boston,	. 60
	26.	Bill at Parker's, 3 days,	7 50
		Fare from Boston to Concord,	. 60
	30.	Fare, Concord to Greenfield,	. 2 85
Nov.	25.	Fare from Greenfield to Boston, and hack,	3 60
	30.	Bill at Parker's, 5 days,	13 00
		Fare, Boston to Greenfield,	. 3 25
Dec.	11.	Fare, Greenfield to Boston,	. 3 25
	14.	Bill at Parker's, 3 days,	7 50
		Fare, Boston to Greenfield,	. 3 25
		Paid express for sundry packages, at sundry times,	1 25
		Bill at Middlesex Hotel in Concord. See account of H. Newton, in Schedule 4.	
			\$122 98

## SCHEDULE, No. 2.

### *Personal Expenses of CHARLES S. STORROW, Commissioner.*

1861.				1861.			
June 29.	Travelling expenses paid,	.	\$2 00		<i>Brought up,</i>	.	\$51 35
July 8, 9, 10.	" " "	.	5 14	Aug. 17.	Travelling expenses paid,	.	2 00
16.	" " "	.	4 20	19.	" " "	.	2 23
17.	" " "	.	2 30		Stationery, &c.,	.	2 62
20.	" " "	.	1 30	22.	Travelling expenses paid,	.	1 20
25.	Ruled paper, stationery, &c.,	4 01		23.	" " "	.	1 35
27.	Travelling expenses paid,	.	2 55	24.	" " "	.	2 50
30.	" " "	.	1 95	27.	" " "	.	2 15
31.	" " "	.	2 05	29.	" " "	.	1 65
Aug. 2.	" " "	.	2 75	Sept. 3.	" " "	.	2 20
3.	" " "	.	2 25	5.	" " "	.	2 20
6.	" " "	.	3 48	6.	" " "	.	3 05
7, 8.	" " "	.	5 27	7.	" " "	.	1 30
9.	" " "	.	2 15	8.	" " "	.	95
12.	" " "	.	2 30	9.	" " "	.	2 25
13.	" " "	.	2 20	11.	" " "	.	2 30
14.	" " "	.	3 10	16.	" " "	.	2 25
16.	" " "	.	2 35	17.	" " "	.	4 90
	<i>Carried up,</i>	.	\$51 35				\$88 45

## SCHEDULE, No. 3.

*Personal Expenses of J. H. SHEDD, Commissioner.*

July	8.	Fares,	.	.	.	.	\$0	75
	9.	"	.	.	.	.		50
	10.	"	.	.	.	.		60
	12.	"	.	.	.	.	1	30
	15.	"	.	.	.	.	1	30
	16.	"	.	.	.	.	1	25
	17.	"	.	.	.	.	1	80
	18.	"	.	.	.	.		50
	19.	"	.	.	.	.	1	30
	20.	"	.	.	.	.	1	30
	22.	"	.	.	.	.	1	25
	24.	"	.	.	.	.	1	30
	26.	"	.	.	.	.		70
	27.	"	.	.	.	.	1	20
	29.	"	.	.	.	.	1	30
	30.	"	.	.	.	.		60
	31.	"	.	.	.	.	1	20
Aug.	1.	"	.	.	.	.		50
	2.	"	.	.	.	.	1	20
	3.	"	.	.	.	.	1	30
	5.	"	.	.	.	.	1	30
	6.	"	.	.	.	.	1	30
	7.	"	.	.	.	.		60
	9.	"	.	.	.	.		60
	10.	"	.	.	.	.		20
	12.	"	.	.	.	.		60
		Carriage,	.	.	.	.		50
	13.	Fares,	.	.	.	.		65
	14.	"	.	.	.	.		65
		Carriage and man,	.	.	.	.	1	28
	15.	Fares,	.	.	.	.		60
	16.	"	.	.	.	.		60
	17.	"	.	.	.	.		60
	19.	"	.	.	.	.		65
	20.	"	.	.	.	.		65
	21.	"	.	.	.	.		60
	22.	"	.	.	.	.		60
	23.	"	.	.	.	.		60
	24.	"	.	.	.	.		65
	26.	"	.	.	.	.		10
	27.	"	.	.	.	.	1	20
	28.	"	.	.	.	.		50
	29.	"	.	.	.	.	1	30
		Carried up,	.	.	.	.	\$37	48
		Brought up,	.	.	.	.	\$37	48
Aug.	30.	Fares,	.	.	.	.		60
	31.	"	.	.	.	.		60
Sept.	2.	"	.	.	.	.	1	20
	3.	"	.	.	.	.	1	20
	4.	"	.	.	.	.		60
	5.	"	.	.	.	.		70
	6.	"	.	.	.	.		60
	7.	"	.	.	.	.		65
	9.	"	.	.	.	.		60
		"	.	.	.	.		65
	10.	"	.	.	.	.	1	20
	11.	"	.	.	.	.	1	25
	12.	"	.	.	.	.	1	20
	13.	"	.	.	.	.	1	20
		Horse in Saxonville,	.	.	.	.		1 00
	16.	Fares,	.	.	.	.	1	25
	24.	"	.	.	.	.		55
	26.	"	.	.	.	.		10
	27.	"	.	.	.	.		10
	28.	"	.	.	.	.	1	30
Oct.	1.	"	.	.	.	.	1	30
	7.	"	.	.	.	.		55
	10.	"	.	.	.	.		70
	14.	"	.	.	.	.		55
	17.	"	.	.	.	.	1	30
	31.	"	.	.	.	.	1	20
Nov.	2.	"	.	.	.	.		60
	9.	"	.	.	.	.	1	20
	20.	"	.	.	.	.	1	20
Dec.	2.	"	.	.	.	.	1	20
		Meals at various times in July,	.	.	.	.	4	53
		" " " " Aug.,	.	.	.	.	1	21
		" " " " Sept.,	.	.	.	.		
		Nov. and Dec.,	.	.	.	.	2	14
		For telegraph and express ex-	.	.	.	.		
		pense at sundry times,	.	.	.	.	1	76
July	12.	Horse hire,	.	.	.	.	2	00
	15.	" "	.	.	.	.	2	00
	16.	" "	.	.	.	.	1	25
Aug.	10.	" "	.	.	.	.	1	50

## SCHEDULE, No. 4.

### *Lauren Mallard—Observer at Station No. 1.*

From July 26 to Sept. 16, inclusive, 53 days' service, at \$1.50,	\$79 50
Extra service on Meadows, 40 days, at 50 cts., . . . . .	20 00
Cash expense, . . . . .	4 28
	\$103 78

### *George C. Wright—Observer at Station No. 2.*

From July 26 to Sept. 16, inclusive, 53 days, at \$1.50, . . .	\$79 50
Cash expense, . . . . .	1 20
	\$80 70

### *Arthur H. Nichols—Observer at Stations Nos. 3 and 19.*

From July 26 to Sept. 16, inclusive, 53 days, at \$1.50, . . .	\$79 50
Cash expense, . . . . .	1 20
	\$80 70

### *Henri A. Mansfield—Assistant Observer at Station No. 3.*

From Aug. 12 to Sept. 18, 38 days, at \$1.50, . . . . .	\$57 00
November 11, 4 days, at \$1.50, . . . . .	6 00
Cash expense, . . . . .	2 67
	\$65 67

### *H. A. Wetherbee—Observer at Station No. 4.*

From July 26 to Sept. 16, 53 days, at \$1.50, . . . . .	\$79 50
Cash expense, . . . . .	1 55
	\$81 05

### *H. D. Noyes—Observer at Station No. 4.*

As Assistant, from Aug. 9 to Sept. 16, 39 days, at \$1.50, . . .	\$58 50
Nov. 3, 3 days, at \$1.50, . . . . .	4 50
	\$63 00

### *D. A. Morse—Observer at Station No. 5.*

From July 26 to Sept. 16, 53 days, at \$1.50, . . . . .	\$79 50
Cash expense, . . . . .	2 80
	\$82 30



*Thomas Mackinnon—Observer at Station No. 6.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Painting poles,	3 00
Cash expense,	70
	<hr/>
	\$83 20

*William H. Kidder—Observer at Station No. 6.*

As Assistant, from Aug. 12 to Sept. 16, 36 days, at \$1.50,	\$54 00
Cash expense,	70
	<hr/>
	\$54 70

*Joseph F. Lathrop—Observer at Station No. 7.*

From July 26 to Sept. 7, 44 days, at \$1.50,	\$66 00
Cash expense,	2 15
	<hr/>
	\$68 15

*Henry Hosmer—Observer at Station No. 7.*

From Sept. 7 to Sept. 16, 10 days, at \$1.50,	\$15 00
Cash expense,	1 25
	<hr/>
	\$16 25

*Charles W. Flint—Observer at Station No. 7.*

As Assistant, from Aug. 8 to Sept. 16, 40 days, at \$1.50,	\$60 00
At sundry times, 17½ days, at \$1.50,	26 25
Rowing from Billerica to Wayland, 37 days, at \$2,	74 00
Board of Thomas J. Grant,	24 50
Allowed extra meals,	8 50
Cash expenses,	2 22
	<hr/>
	\$195 47

*William H. McNeil—Observer at Station No. 8.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	4 80
	<hr/>
	\$84 30

*E. W. Burbank—Observer at Station No. 9.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	6 00
	<hr/>
	\$85 50

*Nathaniel A. Prentiss—Observer at Station No. 10.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	4 22
	<hr/>
	\$83 72

*C. H. Porter—Observer at Station No. 11.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	3 12
	<hr/>
	\$82 62

*Charles Olney—Observer at Stations Nos. 10 and 11.*

As Assistant, from Aug. 9, to Oct. 14, 68 days, at \$1.50,	\$102 00
Cash expense,	1 43
	<hr/>
	\$103 43

*H. T. Clay—Observer at Station No. 12.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	2 60
	<hr/>
	\$82 10

*Andrew M. Morton—Observer at Station No. 13.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Extra service on meadows, 40 days, at 50 cts.,	20 00
November 29, extra, 24 days, at \$1.50, .	36 00
Cash expense,	5 67
	<hr/>
	\$141 17

*Edwin B. D'Arcy—Observer at Station No. 14.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	2 07
	<hr/>
	\$81 57

*Charles P. Ware—Observer at Station No. 15.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	6 20
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	\$85 70

*Goodwin A. Stone—Observer at Station No. 16.*

From July 26 to Aug. 23, 29 days, at \$1.50, .	\$43 50
Cash expense,	6 65
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	\$50 15

*Gorham P. Stevens—Observer at Station No. 16.*

From Aug. 23 to Sept. 16, 25 days, at \$1.50,	\$37 50
Cash expense,	2 75
	<hr/>
	\$40 25

*John E. Hudson—Observer at Station No. 17.*

From July 26 to Aug. 12, 18 days, at \$1.50,	\$27 00
Cash expense,	4 48
	<hr/>
	\$31 48

*Charles E. Hosmer—Observer at Station No. 17.*

From Aug. 12 to Sept. 30, 50 days, at \$1.50,	\$75 00
Cash expense,	1 64
	<hr/>
	\$76 64

*Charles C. Soule—Observer at Station No. 18.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
Cash expense,	4 48
	<hr/>
	\$83 98

*F. C. Nye—Observer at Station No. 19.*

From July 26 to Aug. 26, 32 days, at \$1.50,	\$48 00
Cash expense,	6 20
	<hr/>
	\$54 20

*Charles A. Brackett—Observer at Stations Nos. 3 and 19.*

From Aug. 26 to Sept. 17, 23 days, at \$1.50,	\$34 50
November 3, 3 days, at \$1.50,	4 50
Cash expense,	2 25
	<hr/>
	\$41 25

*Thomas J. Grant—Observer at Station No. 20.*

From July 27 to Sept. 16, 52 days, at \$1.50,	\$78 00
November 30, 4 days, at \$1.75,	7 00
Cash expense,	2 15
	<hr/>
	\$87 15

*Frederick J. Williams—Observer at Station No. 21.*

From July 26 to Aug. 6, 12 days, at \$1.50,	\$18 00
Cash expense,	1 20
	<hr/>
	\$19 20

*E. A. Galloupe—Observer at Station No. 21.*

From Aug. 5 to Sept. 16, 43 days, at \$1.50,	\$64 50
November 11, 3 days, at \$1.50,	4 50
Cash expense,	1 92
	<hr/>
	\$70 92

*Charles F. Williams—Observer at Station No. 22.*

From July 26 to Aug. 3, 8 days, at \$1.50, . . . . .	\$12 00
Cash expense, . . . . .	90
	<hr/>
	\$12 90

*O. J. Ranlett—Observer at Station No. 22.*

From Aug. 7 to Sept. 28, 53 days, at \$1.50, . . . . .	\$79 50
November 11, 6 days, at \$1.50, . . . . .	9 00
Cash expense, . . . . .	3 46
	<hr/>
	\$91 96

*Edward T. Williams—Observer at Station No. 23.*

From July 26 to Aug. 1, 7 days, at \$1.50, . . . . .	\$10 50
Cash expense, . . . . .	1 85
	<hr/>
	\$12 35

*William H. Marshall—Observer at Station No. 23.*

From July 29 to Sept. 16, 50 days, at \$1.50, . . . . .	\$75 00
Cash expense, . . . . .	4 65
	<hr/>
	\$79 65

*Abraham J. Lincoln—Observer at Station No. 23.*

As Assistant from Aug. 8 to Sept. 16, 40 days, at \$1.50, . . . . .	\$60 00
Cash expense, . . . . .	1 55
	<hr/>
	\$61 55

*Jonathan Y. Buzzell—Observer at Station No. 24.*

From July 26 to Sept. 14, 51 days, at \$1.50, . . . . .	\$76 50
Cash expense, . . . . .	3 03
	<hr/>
	\$79 53

*Hiram Morgan—Observer at Station No. 25.*

From July 26 to Sept. 16, 53 days, at \$1.50, . . . . .	\$79 50
Cash expense, . . . . .	3 18
	<hr/>
	\$82 68

*James M. Floyd—Observer at Station No. 26.*

From July 26 to Sept. 16, 53 days, at \$1.50, . . . . .	\$79 50
Cash expense, . . . . .	2 73
	<hr/>
	\$82 23

*James N. Trask—Observer at Station No. 27.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
November 9, 3 days, at \$1.50,	4 50
Cash expense,	3 15
Board,	22 50
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	\$109 65

*Benjamin C. Porter—Observer at Station No. 28.*

From Aug. 20 to Sept. 16, 28 days, at \$1.50,	\$42 00
Cash expense,	1 30
	<hr/>
	\$43 30

*James B. Hale—Observer at Stations Nos. 28 and 34.*

From July 26 to Sept. 16, 53 days, at \$1.50,	\$79 50
November 11, 11 days, at \$1.50,	16 50
Cash expense,	7 15
	<hr/>
	\$103 25

*Luke S. Mills—Observer at Station No. 29.*

From July 26 to Sept 19, 56 days, at \$1.50,	\$84 00
Extra service at Dam, 56 days, at 50 cts.,	28 00
Cash expense,	1 30
	<hr/>
	\$113 30

*George A. White—Observer at Stations Nos. 31 and 32.*

From July 29 to Sept. 16, 50 days, at \$1.50,	\$75 00
Cash expense,	3 90
	<hr/>
	\$78 90

*Charles B. Kendall—Observer at Stations Nos. 33 and 3.*

From Aug. 16 to Nov. —, 60 days, at \$1.50,	\$90 00
Rowing from Billerica to Wayland, 11 days, at \$2,	22 00
Cash expense,	15 17
	<hr/>
	\$127 17

*B. F. Clarke—Assistant Superintendent.*

From July 26, 30½ days, at \$2.50,	\$76 25
Cash expense,	8 94
	<hr/>
	\$85 19

*John M. Rice—Observer at Station No. 34.*

As Observer at Station No. 34, 25 days, at \$1.50,	\$37 50
As Assistant Superintendent, 34 days, at \$2.50,	85 00

## Cash expense—

Transportation, . . . . .	\$5 10
Meals and horsekeeping, . . . . .	2 70
Stationery and postage, . . . . .	1 84
Oil and can, . . . . .	50
Washing, . . . . .	2 81
	<hr/>
	\$135 45

## Charles Pollock—as Accountant.

17 days' services, at \$1.50, . . . . .	\$25 50
Services of Maria Pollock, copying, &c., . . . . .	4 50
Cash expense, . . . . .	1 80
	<hr/>
	\$31 80

## Joel Shedd—General Assistant to Commissioners.

100 days' services, at \$2.50, . . . . .	\$250 00
Merchandise, sundries, . . . . .	20 13
Fares, . . . . .	7 98
Meals for men and horses, . . . . .	8 40
Expressage, . . . . .	3 80
	<hr/>
	\$290 31

## Nathan Edson—Assistant to Joel Shedd.

87 days' services, at \$1.50, . . . . .	\$130 50
Cash expense, . . . . .	6 73
	<hr/>
	\$137 23

## Marshall Conant—

Services 27 days, at \$4, . . . . .	\$108 00
Cash expense, . . . . .	17 29
	<hr/>
	\$125 29

## Hiram F. Mills—

As Observer at Station 30, 68 days, at \$3, . . . . .	\$204 00
Services in the office, 90 days, at \$5, . . . . .	450 00
Cash expense, . . . . .	\$14 80
“ “ . . . . .	16 40
	<hr/>
	31 20
Services of Charles Webster 70½ days, at \$1.25, . . . . .	88 12
Cash expense “ . . . . .	20
	<hr/>
	\$773 52

## Edward F. Kendall—

As Observer at Station 33, 22 days, at \$1.50,	\$33 00
“ Accountant 152 days, at \$2.50,	380 00
Cash expense,	11 44
Charles F. Wood's services and expenses,	1 50
	<hr/>
	\$425 94

## Charles H. Durant—Oarsman and Laborer.

67 days' service, at \$1.50,	\$100 50
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## John O'Brien—Oarsman and Laborer.

77 days' services, at \$1.50,	\$115 50
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## Loring Eaton.

Board of L. Mallard,	\$20 43
Boat,	75
	<hr/>
	\$21 18

## Colonel David Heard—

Board of George C. Wright,	\$22 29
“ “ A. H. Nichols,	14 63
“ “ Charles A. Brackett,	6 00
“ “ H. A. Mansfield,	16 29
“ “ Charles B. Kendall,	12 00
“ “ Charles W. Flint,	6 00
“ “ T. J. Grant,	1 00
“ “ H. F. Mills and men,	2 25
Services on river 26 days, at \$2,	52 00
Cash paid for men and expense of clearing weeds at Robbins's	
Bar,	18 00
Cash expense,	9 54
	<hr/>
	\$160 00

Warren Moore, board of H. A. Wetherbee,	\$18 75
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Jude Damon, board of D. A. Morse,	\$6 00
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## Thaddeus Garfield—

Board of D. A. Morse,	\$13 75
“ “ H. D. Noyes,	13 75
Use of boat,	25
	<hr/>
	\$27 75



## L. H. Sherman—

Board of Thomas Mackinnon, . . . . .	\$2 50
“ “ Jos. F. Lathrop, . . . . .	5 50
Use of horse, . . . . .	50
	<hr/>
	\$8 50

## George Heard—

Board of Thomas Mackinnon, . . . . .	\$20 14
“ “ W. H. Kidder, . . . . .	15 00
“ “ Joel Shedd and N. Edson, . . . . .	86
“ “ C. B. Kendall and one man, . . . . .	3 00
“ “ J. M. Rice, . . . . .	2 50
Use of horse, . . . . .	1 00
	<hr/>
	\$42 50

## Joseph Wellington—

Board of Jos. F. Lathrop, . . . . .	\$17 50
“ “ Charles W. Flint, . . . . .	19 50
“ “ Charles A. Mallory, . . . . .	4 00
Service on river, . . . . .	2 50
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	\$43 50

## Dexter C. Jones—

Board of W. H. McNeil, . . . . .	\$20 82
“ “ Charles Olney, . . . . .	26 32
“ “ H. Hosmer, . . . . .	3 54
“ “ Charles B. Kendall, . . . . .	2 75
“ “ Noyes and Curtis, . . . . .	1 57
“ “ E. F. Kendall and O'Brien, . . . . .	1 57
Use of lantern and oil, . . . . .	1 00
“ “ horse, . . . . .	3 34
	<hr/>
	\$60 91

## George Moore—

Board of E. W. Burbank, . . . . .	\$20 43
Use of boat and lantern, . . . . .	2 00
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	\$22 43

## Elisha Moore—

Board of N. A. Prentiss, . . . . .	20 43
“ “ C. H. Porter, . . . . .	20 43
Lodging two men, . . . . .	1 00
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	\$41 86

Board of H. T. Clay, . . . . .	\$22 29
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## Thomas Cousens—

Board of A. M. Morton, . . . . .	\$29 71
“ “ Edwin B. D’Arcy, . . . . .	29 71
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	\$59 42

## Jonathan M. Dodd—

Board of G. A. Stone, . . . . .	\$2 50
“ “ G. P. Stevens, . . . . .	12 00
“ “ C. P. Ware, . . . . .	13 00
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	\$27 50

## Nathan S. Hosmer—

Board of G. A. Stone, . . . . .	\$11 50
“ “ F. C. Nye, . . . . .	15 50
“ “ C. P. Ware, . . . . .	14 00
“ “ John E. Hudson, . . . . .	8 50
Lantern and oil, . . . . .	1 00
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	\$50 50

## Willard Wilson—

Board of C. E. and H. Hosmer, . . . . .	\$16 00
Oil, &c., . . . . .	25
	<hr/>
	\$16 25

## Miss Carrie Hunt—

Board of F. J. Williams, . . . . .	\$6 28
“ “ C. F. Williams, . . . . .	4 75
“ “ E. T. Williams, . . . . .	4 00
“ “ O. J. Ranlett, . . . . .	29 71
“ “ E. A. Galloupe, . . . . .	24 00
“ “ A. J. Lincoln, . . . . .	21 14
“ “ J. B. Cunningham, . . . . .	2 85
“ “ Lewis and Leonard Ranlett, . . . . .	4 56
Dinners for Carpenters, . . . . .	50
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	\$97 61

## Thomas F. Hunt—

Board of William H. Marshall, . . . . .	\$24 00
Use of horse and lantern, . . . . .	1 50
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	\$25 50

Francis Hunt, board of Jonathan Y. Buzzell, . . . . . \$20 43

B. J. Davis, board of Hiram Morgan, . . . . . \$19 44

Artemas Hill, board of James M. Floyd, . . . . \$21 21

Robert Call, board of Benjamin C. Porter, . . . . \$12 00

John Pasho—

Board of Hiram F. Mills, . . . . \$32 50

“ “ Luke S. Mills, . . . . 28 00

Sunday meals and lodgings, . . . . 18 75

Use of boat and horse, . . . . 2 25

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\$81 50

Samuel Rogers, board of James B. Hale, . . . . \$8 75

S. S. Wood, board of George A. White, . . . . \$22 50

William D. Brown, board of E. F. and C. B. Kendall, . . \$24 00

Services, . . . . 25

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\$24 25

J. W. Goodnow—

Board of John M. Rice, . . . . \$13 68

“ “ James B. Hale, . . . . 15 00

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\$28 68

William Russell—

Lodging of A. H. Nichols, . . . . \$4 12

Use of boat, . . . . 10 00

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\$14 12

Isaac S. Lee, sundry meals and use of horse, . . . . \$4 00

John R. Rollins, services, copying, &c., . . . . \$30 00

T. C. Whittemore, services on river, \$1.50, and cash ex-  
penses, \$1.20, . . . . \$2 70

Cushing C. Harlow, services on river,  $3\frac{6}{10}$  days, . . . . 7 20

P. B. Stickney, services on meadows, . . . . 4 40

J. A. Colson, services on dam 2-days, \$4.; lumber, 58 cts., . . 4 58

Thomas Doane, services on river, . . . . 2 00

Charles Moulton, services on river, \$2.75; lumber, \$3.25, . . 6 00

American Powder Company, services rendered, . . . . 5 00

H. W. Hartwell, use of office No. 39 State Street, . . . . 30 00

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\$61 88

## George F. Shedd—

Two days' work on measuring poles, . . . . .	\$4 00
Expenses on stencil plates, . . . . .	13
Three days' work on wind gauges, . . . . .	6 00
Steel for spindles, . . . . .	06
Wood screws, . . . . .	08
Tin for shields, . . . . .	20
Packing box, . . . . .	10
Wood for stand or case, . . . . .	10
28 lbs. iron castings, . . . . .	1 12
	<hr/>
	\$11 79

## Albert H. Shedd—

Services on tables, . . . . .	\$5 06
Cash expenses, . . . . .	67
Lanterns, . . . . .	2 00
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	\$7 73

## William Edson—

Painting poles, . . . . .	\$4 00
Vanes for anemometers, . . . . .	1 50
15 lbs. brass castings, at 2 shillings, . . . . .	5 00
Mounted paper, . . . . .	3 00
	<hr/>
	\$13 50

## Callander &amp; Learned—

8 yards fence chain, at 15 cts., . . . . .	\$1 20
1 ball twine, 15 cts.; 1 pair cutting plyers, 50 cts., . . . . .	65
Half dozen padlocks, at \$1.20, . . . . .	60
2 pocket levels, at 15 cts., . . . . .	30
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	\$2 75

George W. Walker, 4 tin vanes, . . . . .	\$1 50
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## Francis Buttrick—

478 feet spruce boards and joist, at 14 cts., . . . . .	\$6 69
83 " " " at 15 cts., . . . . .	1 24
Sawing, . . . . .	17
228 feet spruce boards, at 15 cts., . . . . .	3 42
Sawing, . . . . .	57
581 feet spruce boards, at 14 cts., . . . . .	8 13
394 " " at 15 cts., . . . . .	5 91
Sawing, . . . . .	98

680 feet spruce boards, at 14 cts.,	\$9 38
Loading,	37
190 feet 2x3 spruce, at 15 cts.,	2 85
177 feet spruce boards, at 16 cts.,	2 83
Sawing,	40
1,075 feet spruce boards, at 14 cts.,	15 05
Carting to Wayland,	2 00
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	\$59 99

## George Blake—

Patterns, boxes and work on anemometers,	\$24 91
150 ten-foot poles,	31 25
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	\$56 16

## Winsor &amp; Whitney—

5 12½-foot dories, at \$13.50,	\$67 50
6 pairs 8½-foot oars, at \$1.25,	7 50
5 sets thole pins,	1 25
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	\$76 25

## Joseph M. Wightman &amp; Son—

5 zinc rain gauges,	\$30 00
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## George L. Prescott—

37 feet rails, at \$1.88,	\$0 74
153 feet boards, at \$1.88,	2 29
10½ feet pine boards,	38
1,005 feet spruce boards,	11 06
52 feet spruce boards,	78
327 feet boards,	3 60
59 feet spruce boards,	89
60 feet spruce boards,	90
	<hr/>
	\$20 64

## Thomas Hall—

Work and stock for windometers,	\$9 00
1 level,	1 50
4 leveling screws,	2 00
Extra work,	3 50
Work on windometers,	3 00
1 level,	1 50
Repairing windometers,	4 00
	<hr/>
	\$24 50

## J. S. Alden—

7 lbs. white lead paint, at 1 shilling,	\$1 17
Services marking poles,	2 75
Three-fourths pint of varnish,	37
White lead and varnish,	25
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	\$4 54

## Mark Pope—

Services stencilling poles, 1 day,	\$2 50
“ “ “ 3 days,	7 50
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	\$10 00

## Thomas Talbot—

Cash paid for services of L. B. Gannon,	\$2 50
“ “ John Driscoll,	2 50
“ “ Timothy McGuire,	2 50
“ “ John Buckley,	2 50
“ “ Thomas Coglein,	2 50
“ “ Daniel Murphy,	2 50
“ “ John Driscoll,	1 25
“ “ Daniel Murphy,	1 25
“ M. Page, for board,	3 75
	<hr/>
	\$21 25

George W. Todd, coach fares, \$3.38; use of horse, \$2, . . . \$5.38

## Manson &amp; Alden—

Use of horse, July 26th, \$2; 30th, \$2; Aug. 1st, \$2,	\$6 00
Aug. 1st, \$2; 28th, \$2; Sept. 24th, \$2; Oct.	
7th, \$2; 14th, \$2; Nov. 2d, \$4; 8th, \$3,	17 00
Horses and teaming,	8 00
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	\$31 00

Adams Express Co., expressage from July to Oct., inclusive, . . . \$5 00

M. Glazier, use of horses at sundry times, . . . \$8 50

## F. E. Bigelow—

30 clamps,	\$4 50
8 rings and 4 staples,	63
3 sets rudder irons,	1 89
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	\$7 02

J. M. Maynard, for sundry services, . . . \$5 00

Thomas B. Battles, use of boat, . . . . .	\$1 00
George E. Sherman, " " . . . . .	1 00
William G. Barrett, " " . . . . .	2 50
Nathan Barrett, " " . . . . .	2 00
Nathan S. Johnson, " " . . . . .	1 50
Edward Carter, " " . . . . .	1 00
J. P. George, " " . . . . .	1 50
Dexter Sherman, " " . . . . .	1 00
Jonathan Hill, " " . . . . .	1 00
J. N. Moore, " " . . . . .	2 00
J. P. Fairbanks, " " . . . . .	2 00
E. Russell, service and use of boat, . . . . .	2 00
Isaac Underwood, use of boat, . . . . .	2 00
George Durant, horse and wagon, \$1 ; use of boat, \$4, . . . . .	5 00
Benjamin Dudley, use of boat, . . . . .	3 00
Mr. Taylor, " " . . . . .	3 00
E. W. Giles, " " . . . . .	3 00
Mr. Bent, " " . . . . .	3 00
Frank Underwood, " " . . . . .	3 00
Isaiah Nealy, " " . . . . .	3 00
Frederick Harlow, " " . . . . .	3 00
F. B. Sanborn, " " . . . . .	—
Frank Munroe, " " . . . . .	3 00
Gardner Heywood, " " . . . . .	3 00
Benjamin F. Nealy, " " . . . . .	1 50
Joseph Dane, " " . . . . .	2 50
A. L. Jewell, " " . . . . .	12 00
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	\$68 50

J. R. Cunningham, services as Observer on river, . . . . . \$8 00

Miscellaneous Expenses—

Note books, \$1.51 ; telegraph and express, \$2.26, . . . . .	\$3 77
Carpenter's level, 80 cts. ; nails and screws, 39 cts., . . . . .	1 19
Map of vicinity of Boston, 25 cts. ; lumber, 90 cts., . . . . .	1 15
Lanterns, \$5.43 ; getting boats for observers, 50 cts., . . . . .	5 93
Twine, 45 cts. ; bottles and shot, 27 cts., . . . . .	72
Rudders for boats, 75 cts. ; laborers' setting Stations, \$1.50, . . . . .	2 25
Rowlocks, 67 cts. ; Messenger bringing news, 50 cts., . . . . .	1 17
Freight on boats, \$3.25 ; building Station 34, \$6, . . . . .	9 25
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	\$25 43



## Cash paid for—

Meals for men, at sundry times, . . . . .	\$2 00
Fares, “ “ “ . . . . .	5 85
Postage, “ “ . . . . .	1 74
Services of Mr. Holbrook, . . . . .	1 00
Porterage and express, . . . . .	25
Note-book, 18 cts.; Needles for points, 4 cts., . . . . .	22
Nails, . . . . .	04
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	\$11 10
John Cameron, use of boat, . . . . .	\$1 50
Mr. Bowers, “ “ . . . . .	1 00
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	\$2 50

## Aaron R. Gay—

52 cap memorandums, printed to order, . . . . .	\$20 00
Pencils, . . . . .	4 29
Rubber, . . . . .	1 63
Ruling paper, . . . . .	1 50
6 memorandums, . . . . .	8 63
Drawing paper, . . . . .	5 00
Half ream cap, . . . . .	1 38
9 quires cap, ruled to order, . . . . .	2 62
5½ doz. x section paper, . . . . .	8 25
Rubber bands, 9 cts.; one gross pens, 80 cts., . . . . .	89
1 quire note, 17 cts.; 25 envelopes, 8 cts.; ink, 30 cts., . . . . .	55
½ quire bill paper, . . . . .	19
4 pen holders, 13 cts.; mucilage, 25 cts.; note paper, 34 cts., . . . . .	72
50 envelopes, 16 cts.; 1 cap, quire book, 50 cts., . . . . .	66
Blotting, 12 cts.; bands, 10 cts., . . . . .	22
18 cap memorandums, printed to order, . . . . .	15 00
Note paper, 88 cts.; 2 quires cap, printed to order, \$1, . . . . .	1 88
1 tuck memorandum, 50 cts.; 1 box labels, 15 cts., . . . . .	65
6 sheets blue cap, 6 cts.; 50 sheets cap, ruled to order, \$1.50, . . . . .	1 56
Fastening and binding documents, . . . . .	1 12
1 doz. x section paper, . . . . .	1 50
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	\$78 24

## Shedd &amp; Edson—

Services of William Edson, 19 $\frac{6}{8}$ days, at \$8, . . . . .	\$158 00
Chas. A. Mallory, draughtsman, 61 $\frac{5}{8}$ days, at \$4, . . . . .	246 50
J. H. Curtis, 8 $\frac{7}{8}$ days, at \$3, . . . . .	26 62

Services of William H. Foss, 52 $\frac{7}{8}$ days, at \$3.50,	\$185 06
S. L. Minot, leveller, 53 days, at \$5,	265 00
John A. Cole, rodman, 51 days, at \$2,	102 00
John A. Cole, leveller, 55 $\frac{1}{8}$ days, at \$3.50,	192 93
William N. Harlow, 92 days, at \$2,	184 00
J. J. Boardman, 24 $\frac{6}{8}$ days, at \$2,	49 50
D. H. Sherman, 1 $\frac{2}{8}$ days, at \$2,	2 50
C. D. Stocker, 10 days, at \$1.50,	15 00
J. E. Parsons, 13 $\frac{3}{16}$ days, at \$2,	26 38
Cash expense of William Edson,	3 69
C. A. Mallory,	3 37
J. H. Curtis,	70
W. H. Foss,	2 90
Samuel Minot, meals, \$2.05; fares, \$11.05; board of party at Saxonville, \$3.25,	16 35
John A. Cole, fares, \$5.10; washing, \$8; sundries, \$3.59,	16 69
Wm. N. Harlow, washing, \$8; fares, \$1.55; expenses in Boston, \$1.40; expense on trunk, 25 cts.,	11 20
J. J. Boardman,	3 00
H. D. Sherman,	29
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	\$1,511 68

## M. Page—

Board of men, 23 $\frac{2}{7}$ weeks, at \$4,	\$94 85
Entertainment of men July 13,	2 00
Horses and men, July 17th, \$2.25; 18th, \$2.25; 19th, \$2.25; 25th, \$1.25; 31st, \$2.50,	10 50
August 2d, 75 cts.; 3d, \$3.50; 31st, \$1,	5 25
Use of horses, July 13th, \$1; 26th, \$1; 29th, 50 cts.; 30th, \$1.75,	4 25
August 1st, \$2.50; 3d, \$1; 5th, \$2; 6th, 75 cts.; 7th, 75 cts.; 8th, 50 cts.; 12th, \$1,	8 50
August 13th, 25 cts.; 14th, 25 cts.; 15th, \$1.25; 16th, \$1; 20th, 25 cts. 23d, \$1; 24th, \$2.75,	6 75
August 26th, \$2.50; 27th, \$1; 28th, \$1.25; 29th, \$1.25,	6 00
September 2d, \$1; 3d, \$1.25; 5th, 50 cts.; 17th, \$1; 24th, 25 cts.; 25th \$1.50; 26th, \$2,	7 50
September 27th, \$2.50; 28th, \$2.75; 30th, \$4.50,	9 75
October 1st, \$1.50; 2d, \$1.25; 3d, \$2.50; 5th, \$1.25,	6 50
November 4th, \$1.50; 13th, \$2.25; 29th, \$1.25; J. B. Draper, \$1.50,	6 50

26 feet boards, . . . . .	\$0 39
Express, . . . . .	63
Man to dig, and express, . . . . .	1 75
Man to go to Concord, and 2 horses and carriage, . . . . .	2 00
Repairs on buggy, . . . . .	1 83
Paid Draper for horse, . . . . .	3 00
Two days' work of men, . . . . .	2 00
November 2d, board and use of horse and wagon, and 3 days	
1 meal board, . . . . .	5 00
Meals for Kendall, Brackett, Curtis, and Noyes, . . . . .	1 80
Keeping horse, . . . . .	75
November 3d, 1 day's board of Brackett, . . . . .	57
Extra meals to October 9th from October 5, . . . . .	4 00
Horse, . . . . .	2 00
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	\$192 07

## H. Newton—

Board of D. W. Alvord, . . . . .	\$16 91
J. H. Shedd, . . . . .	26 76
Joel Shedd, . . . . .	43 78
N. Edson, . . . . .	36 03
J. A. Cole, . . . . .	37 17
W. N. Harlow, . . . . .	45 71
S. L. Minot, . . . . .	25 71
M. Conant, . . . . .	19 18
B. F. Clarke, . . . . .	19 42
C. C. Soule, . . . . .	28 57
John M. Rice, . . . . .	17 71
E. F. Kendall, . . . . .	18 28
Charles E. Hosmer, . . . . .	12 00
Charles A. Brackett, . . . . .	5 71
Charles A. Mallory, . . . . .	5 14
John J. Boardman, . . . . .	9 71
Wm. H. Foss, . . . . .	12 00
A. Morton, . . . . .	12 00
John O'Brien, . . . . .	38 29
Charles H. Durant, . . . . .	37 14
A. H. Nichols, . . . . .	6 28
Mr. Hurd, . . . . .	6 00
T. J. Grant, \$3 ; W. H. Marshall, \$1 ; Galloupe, \$1, . . . . .	5 00
J. B. Cunningham, \$1.50 ; Hale, 75 cts. ; G. P. Stevens, \$1.50 ;	
H. F. Mills, \$1.50, . . . . .	5 25

Morton and D'Arcy, 75 cts.; Flint, 38 cts.; C. B. Kendall, \$3; Flint, 75 cts., . . . . .	\$4 88
T. Mackinnon, \$1.50; Ranlett, 38 cts.; Otis Tuft, Jr., 38 cts.; F. Mansfield, \$1.50, . . . . .	3 76
Galloupe, \$1.50; Ranlett, 38 cts., . . . . .	1 88
Sundry meals, July 26th, \$6; 27th, \$4; 31st, \$2.25; Aug. 9th, \$1.13, . . . . .	13 38
Horses and men, July 19th, \$4.50; 20th, \$4.50; Sept. 21st, \$1.25, . . . . .	10 25
Sundry services—Men, July 20th, 50 cts.; 22d, \$2; 23d, \$2; 24th, \$2.50; 25th, \$2.50; 26th, \$2.50; 27th, 50 cts.; 27th, \$1.25, . . . . .	13 75
July 31st, \$1; Aug. 1st, \$3; 1st, \$1.25; 20th, 50 cts., . . . . .	5 75
Railroad bill, . . . . .	50
Cash paid for burying horse, . . . . .	2 00
Use of horses, July 20, \$5; 22d, \$4; 23d, \$3; 24th, \$6.50; 25th, \$7; 26th, \$5.50; 27th, \$2.25; 29th, \$6.50, . . . . .	39 75
July 30th, \$4; 31st, \$10.50; Aug. 1st, \$8; 2d, \$10.50; 3d, \$8; 4th, \$4; 5th, \$8; 6th, \$1.50; 7th, \$10, . . . . .	64 50
Aug. 8th, \$3.50; 9th, \$5.75; 10th, \$5.50; 11th, \$7; 12th, \$4; 13th, \$6; 14th, \$6; 15th, \$5; 16th, \$2.75, . . . . .	45 50
Aug. 17th, \$5; 18th, \$1; 19th, \$6; 20th, \$6; 21st, \$8; 22d, \$5; 23d, \$7; 24th, \$3.50; 26th, \$4, . . . . .	45 50
Aug. 27th, \$4; 28th, \$2; 29th, \$6; 30th, \$5; 31st, \$4.50; Sept. 1st, \$2.50; 2d, \$4; 3d, \$4, . . . . .	32 00
Sept. 4th, \$7.50; 4th, \$1.25; 5th, \$7; 6th, \$6; 7th, \$7; 8th, \$2; 9th, \$4.50; 10th, \$5.50; 12th, \$3.50; 13th, \$7.50, . . . . .	51 75
Sept. 14th, \$4; 16th, \$8; 17th, \$2; 18th, \$3; 19th, \$4.50; 20th, \$2; 24th, \$1.50; Oct. 3d, \$5, . . . . .	30 00
Oct. 4th, \$2.50; 7th, \$3; 9th, \$3; 10th, \$2.75; 10th, \$2.50; 14th, \$3.75; 15th, \$4.50; 16th, \$3.50; 17th, \$2, . . . . .	27 50
Oct. 18th, \$4; 23d, \$2; Nov. 2d, \$4; 3d, \$5; 8th, \$1.50; 9th, \$8; 10th, \$3; 11th, \$4; 20th, \$1.50, . . . . .	33 00
Boat, . . . . .	1 00
Use of office two months, . . . . .	5 00
5 lanterns, . . . . .	6 25
Rowlock, . . . . .	50
Board of Charles Pollock, . . . . .	9 74

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 \$937 89

Expense of boat for Station No. 3, H. Newton, . . . . . \$10 00

Extra services of H. F. Mills, on tables for Commissioners, 4	
days, at \$5, . . . . .	\$20 00
Extra services of E. F. Kendall, as accountant, 8 days, at \$2.50,	20 00
Parsons and Stocker, on tables, . . . . .	3 50
Albert H. Shedd, . . . . .	75
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	\$44 25

S. H. Rhoades, use of boat, . . . . . \$5 00

Total amount, . . . . . \$10,057 82

*Cr.*

Sept. 4, Check of State Treasurer, . . . . .	\$1,454 93	
“ 9, “ “ “ . . . . .	543 93	
Nov. 1, “ “ “ . . . . .	482 63	
Cash received by sale of boats, . . . . .	65 00	
“ “ “ “ lanterns, . . . . .	1 25	
“ “ “ “ shanties, . . . . .	7 50	
“ “ “ “ 1 screw clamp, . . . . .	25	
“ “ “ “ 1 carpenters' level, . . . . .	50	
1 tuck memo. less in A. R. Gay's account, . . . . .	50	
	<hr/>	2,556 49
		<hr/>
		\$7,501 33

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Part of Table [A.]

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OBSERVED HEIGHTS

ON

CONCORD AND SUDBURY RIVERS.

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WEDNESDAY, AUGUST 7, 1861.

STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	12.94	12.96	12.96	12.96	12.93	12.89	12.84	12.82	12.80	12.78	12.77	12.76	12.75	12.74	12.74	12.73	12.73
2, . .	12.76	12.77	12.78	12.78	12.78	12.79	12.79	12.79	12.78	12.78	12.78	12.77	12.77	12.76	12.75	12.74	12.73
3, . .	12.70	12.70	12.71	12.71	12.71	12.71	12.72	—	—	12.71	12.71	12.71	12.70	12.70	12.70	12.69	12.69
4, . .	12.66	12.66	12.67	12.67	12.68	12.68	12.69	12.69	12.69	12.68	12.68	12.68	12.67	12.67	12.67	12.66	12.66
5, . .	12.44	12.44	12.44	12.44	12.44	12.44	12.45	12.45	12.45	12.45	12.45	12.45	12.45	12.45	12.45	12.45	12.45
6, . .	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.45	12.45	12.45	12.45	—	—
7, . .	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.13	12.13	12.13	12.13	12.13	12.13	12.13	—	—
8, . .	12.15	12.15	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14
9, . .	11.98	11.98	11.98	11.98	11.98	11.98	11.97	11.97	11.97	11.97	11.97	11.97	11.97	11.97	11.97	11.97	11.97
10, . .	11.96	11.97	11.97	11.97	11.97	11.97	11.97	11.96	11.96	11.96	11.96	11.96	11.96	11.95	11.95	11.95	11.95
11, . .	11.73	11.74	11.74	11.74	11.74	11.74	11.74	11.73	11.73	11.73	11.72	11.72	11.72	11.72	11.72	11.71	11.72
12, . .	11.71	11.71	11.71	11.71	11.71	11.71	11.71	11.71	11.70	11.70	11.70	11.70	11.69	11.69	11.69	11.69	11.69
13, . .	11.69	11.69	11.70	11.70	11.69	11.69	11.69	11.69	11.68	11.68	11.68	11.68	11.68	11.68	11.67	11.67	11.67
14, . .	11.68	11.68	11.68	11.68	11.68	11.68	11.67	11.67	11.67	66.67	11.67	11.67	11.66	11.66	11.66	11.65	11.65
15, . .	11.64	11.64	11.64	11.64	11.64	11.62	11.61	11.61	11.62	11.62	11.62	11.61	11.61	11.61	11.61	11.61	11.61
16, . .	11.64	11.63	11.63	11.63	11.62	11.61	11.60	11.60	11.61	11.61	11.61	11.60	11.60	11.60	11.60	11.60	11.59
17, . .	11.49	11.48	11.47	11.46	11.44	11.41	11.41	11.42	11.43	11.44	11.42	11.40	11.40	11.42	11.42	11.43	11.43

APPENDIX.

[Jan.

18,	.	.	11.51	11.50	11.49	11.48	11.45	11.42	11.42	11.44	11.45	11.46	11.44	11.42	11.42	11.44	11.45	11.46	11.44
19,	.	.	11.17	11.16	11.16	11.15	11.15	11.12	11.11	11.11	11.12	11.12	11.11	11.09	11.08	11.09	11.11	11.12	11.11
20,	.	.	11.12	11.11	11.11	11.10	11.09	11.07	11.06	11.05	11.06	11.06	11.06	11.03	11.03	11.03	11.04	11.05	11.05
21,	.	.	11.11	11.10	11.09	11.09	11.08	11.05	11.04	11.04	11.05	11.05	11.05	11.03	11.02	11.02	11.03	11.03	11.03
22,	.	.	10.73	10.73	10.73	10.72	10.71	10.70	10.68	10.68	10.68	10.68	10.67	10.65	10.65	10.65	10.65	10.65	10.64
23,	.	.	10.60	10.61	10.60	10.60	10.60	10.59	10.57	10.57	—	10.56	10.55	10.54	10.53	10.53	10.53	10.53	10.53
24,	.	.	10.55	10.55	10.55	10.55	10.56	10.55	10.53	10.52	10.50	10.50	10.49	10.48	10.48	10.47	10.48	10.47	10.45
25,	.	.	10.54	10.54	10.54	10.54	10.53	10.53	10.52	10.51	10.50	10.50	10.49	10.47	10.47	10.47	10.47	10.45	10.44
26,	.	.	10.53	10.53	10.53	10.53	10.52	10.52	10.51	10.50	10.49	10.49	—	10.48	10.47	10.47	10.46	10.46	10.45
27,	.	.	10.55	10.54	10.54	10.53	10.52	10.50	10.50	10.49	10.51	10.50	10.49	10.49	10.49	10.48	10.46	10.41	10.38
28,	.	.	10.49	10.47	10.47	10.45	10.43	10.42	10.41	10.41	10.45	10.42	10.41	10.41	10.41	10.41	10.34	10.26	10.23
29,	.	.	10.27	10.15	10.19	10.07	10.05	—	10.02	10.04	10.12	10.05	10.02	10.05	10.07	10.07	9.46	8.83	8.75
30,	.	.	10.27	10.15	10.19	10.08	10.05	10.07	10.02	10.04	10.14	10.06	—	10.07	10.07	10.07	9.47	8.83	8.75
31,	.	.	12.87	12.85	12.86	12.69	12.61	12.70	12.79	12.87	12.85	12.73	12.65	12.78	12.84	12.86	12.87	12.77	12.60
32,	.	.	13.04	13.02	13.02	12.85	12.81	12.90	13.00	13.06	13.05	12.95	12.92	13.03	13.09	13.10	13.11	13.04	12.92
33,	.	.	17.53	17.55	16.83	17.35	17.43	17.61	17.53	17.49	16.88	17.41	17.49	17.50	17.47	17.47	17.35	17.06	16.39
34,	.	.	16.26	16.26	15.97	15.75	15.73	15.73	15.72	15.73	15.72	15.69	—	15.71	15.71	15.71	15.71	15.72	15.71

# THURSDAY, AUGUST 8, 1861.

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STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	12.96	12.99	13.01	13.02	12.98	12.93	12.89	12.85	12.84	12.82	12.81	12.80	12.79	12.59	12.78	12.78	12.77
2, . .	12.77	12.78	12.79	12.80	12.81	12.82	12.82	12.82	12.81	12.81	12.81	12.80	12.80	12.79	12.79	12.79	12.79
3, . .	12.71	12.71	12.72	12.73	12.74	12.75	12.75	12.75	12.75	12.75	12.75	12.75	22.74	12.74	12.74	12.74	12.74
4, . .	12.68	12.68	12.69	12.70	12.71	12.72	12.72	12.72	12.72	12.72	12.72	12.72	12.72	12.71	12.71	12.71	12.71
5, . .	12.46	12.46	12.47	12.47	12.47	12.47	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.49	12.48	12.48	12.48
6, . .	12.44	12.44	12.44	12.44	12.45	12.45	12.45	12.45	12.46	12.46	12.46	12.46	12.46	12.46	12.46	—	—
7, . .	12.15	12.15	12.15	12.15	12.15	12.15	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	—	—
8, . .	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.14	12.14	12.14	12.14	12.14	12.14	12.13	12.13	12.13
9, . .	11.97	11.97	11.97	11.97	11.97	11.96	11.96	11.96	11.96	11.95	11.95	11.95	11.95	11.95	11.95	11.95	11.95
10, . .	11.96	11.95	11.95	11.95	11.95	11.95	11.94	11.94	11.94	11.94	11.93	11.93	11.93	11.93	11.93	11.92	11.92
11, . .	11.70	11.70	11.69	11.68	11.68	11.67	11.67	11.66	11.66	11.66	11.66	11.66	11.66	11.66	11.65	11.65	11.64
12, . .	11.68	11.67	11.67	11.65	11.65	11.64	11.64	11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63
13, . .	11.64	11.64	11.64	11.63	11.62	11.62	11.62	11.61	11.61	11.61	11.61	11.62	11.61	11.61	11.60	11.60	11.59
14, . .	11.61	11.61	11.60	11.59	11.58	11.58	11.58	11.58	11.58	11.58	11.59	11.59	11.58	11.58	11.58	11.57	11.57
15, . .	11.52	11.52	11.51	11.50	11.51	11.51	11.51	11.52	11.53	11.54	11.54	11.54	11.53	11.51	11.50	11.50	11.49
16, . .	11.51	11.50	11.49	11.49	11.49	11.49	11.50	11.51	11.52	11.53	11.53	11.52	11.51	11.50	11.48	11.47	11.48
17, . .	11.19	11.18	11.17	11.17	11.20	11.22	11.25	11.29	11.32	11.33	11.32	11.30	11.26	—	11.22	11.23	11.25

APPENDIX.

[Jan.

18,	.	.	11.19	11.17	11.17	11.17	11.20	11.23	11.27	11.31	11.34	11.36	11.35	11.31	11.28	11.23	11.22	11.24	11.27
19,	.	.	10.88	10.86	10.85	10.84	10.86	10.87	10.90	10.93	10.95	10.97	10.97	10.95	10.92	10.88	10.86	10.86	10.88
20,	.	.	10.83	10.81	10.80	10.79	10.79	10.80	10.82	10.85	10.87	10.89	10.89	10.88	10.85	10.82	10.80	10.79	10.80
21,	.	.	10.82	10.80	10.79	10.78	10.78	10.79	10.82	10.84	10.86	10.87	10.88	10.86	10.84	10.81	10.79	10.78	10.79
22,	.	.	10.45	10.42	10.42	10.38	10.38	10.37	10.37	10.37	10.38	10.38	10.38	10.37	10.35	10.34	10.32	10.32	10.29
23,	.	.	—	10.30	10.29	10.28	10.26	10.25	10.24	10.24	10.24	10.23	10.23	10.23	10.21	10.20	10.19	10.18	10.18
24,	.	.	10.29	10.26	10.24	10.23	10.21	10.19	10.18	10.16	10.15	10.15	10.14	10.13	10.13	10.12	10.11	10.10	10.09
25,	.	.	10.27	10.25	10.23	10.21	10.20	10.18	10.16	10.15	10.14	10.14	10.13	10.12	10.12	10.11	10.10	10.09	10.08
26,	.	.	10.27	10.24	10.22	10.20	10.19	10.17	10.16	10.14	10.13	10.12	10.12	10.11	10.11	10.10	10.09	10.08	10.07
27,	.	.	10.24	10.22	10.20	10.19	10.17	10.15	10.14	10.12	10.11	10.11	10.10	10.09	10.09	10.08	10.07	10.07	10.06
28,	.	.	10.10	10.09	10.07	10.05	10.04	10.02	10.01	9.99	9.99	9.98	9.97	9.97	9.97	9.96	9.95	9.95	9.94
29,	.	.	8.62	8.75	8.83	8.76	8.69	8.65	8.66	8.68	8.73	8.69	9.67	8.72	8.71	8.72	8.72	8.77	8.78
30,	.	.	8.61	8.75	8.84	8.75	8.69	8.64	8.65	8.67	8.72	8.68	8.67	8.72	8.70	8.71	8.72	8.77	8.79
31,	.	.	12.07	12.08	12.18	12.44	12.50	12.68	12.78	12.81	12.84	12.72	12.58	12.45	12.36	12.42	12.54	12.69	12.76
32,	.	.	12.63	12.61	12.61	12.71	12.76	12.90	13.00	13.03	13.05	12.96	12.89	12.85	12.84	12.86	12.90	13.00	13.05
33,	.	.	16.59	17.34	16.88	17.38	17.54	17.51	17.49	17.48	16.84	16.87	16.54	17.06	17.16	17.16	17.59	17.54	17.25
34,	.	.	16.38	16.38	16.05	15.78	15.73	15.72	15.72	15.72	15.71	15.69	15.69	15.70	15.69	15.69	15.69	15.68	15.68

FRIDAY, AUGUST 9, 1861.

STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	12.89	12.94	12.99	13.00	12.96	12.92	12.87	12.85	12.83	12.82	12.81	12.80	12.80	12.79	12.79	12.79	12.78
2, . .	12.78	12.79	12.80	12.81	12.82	12.82	12.83	12.83	12.82	12.81	12.81	12.81	12.80	12.80	12.80	12.80	12.79
3, . .	12.73	12.73	12.74	12.74	12.75	12.75	12.76	12.77	12.76	12.76	12.76	12.76	12.76	12.75	12.75	12.75	12.75
4, . .	12.70	12.70	12.71	12.71	12.72	12.73	12.73	12.74	12.74	12.74	12.73	12.73	12.73	12.73	12.73	12.73	12.72
5, . .	12.47	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.48	12.49	12.49	12.49	12.49
6, . .	12.47	12.47	12.47	12.47	12.47	12.47	12.46	12.46	12.46	12.46	12.47	12.47	12.47	12.47	12.47	—	—
7, . .	12.13	12.13	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.11	12.11	12.11	12.11	12.11	—	—
8, . .	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.12	12.11	12.11	12.11	12.11	12.11
9, . .	11.94	11.94	11.93	11.93	11.93	11.93	11.92	11.92	11.92	11.92	11.92	11.92	11.91	11.91	11.91	11.91	11.91
10, . .	11.91	11.91	11.91	11.91	11.90	11.90	11.90	11.90	11.90	11.89	11.89	11.89	11.89	11.89	11.89	11.89	11.89
11, . .	11.63	11.63	11.63	11.62	11.62	11.62	11.61	11.61	11.61	11.60	11.60	11.60	11.60	11.60	11.59	11.59	11.59
12, . .	11.60	11.60	11.60	11.60	11.59	11.59	11.59	11.58	11.58	11.58	11.57	11.57	11.57	11.57	11.57	11.56	11.56
13, . .	11.58	11.58	11.58	11.58	11.57	11.57	11.57	11.57	11.56	11.56	11.56	11.56	11.55	11.55	11.55	11.55	11.55
14, . .	11.55	11.55	11.55	11.55	11.54	11.54	11.54	11.54	11.53	11.53	11.53	11.53	11.52	11.52	11.52	11.52	11.52
15, . .	11.49	11.49	11.49	11.49	11.48	11.48	11.48	11.47	11.47	11.47	11.47	11.46	11.46	11.45	11.45	11.45	11.45
16, . .	11.48	11.47	11.47	11.47	11.47	11.47	11.46	11.46	11.45	11.45	11.44	11.44	11.44	11.43	11.43	11.44	11.44
17, . .	11.23	11.22	11.22	11.22	11.22	11.21	11.20	11.20	11.20	11.20	11.20	11.18	11.18	11.18	11.20	11.21	11.21

18,	.	.	11.25	11.24	11.23	11.24	11.24	11.22	11.21	11.21	11.21	11.22	11.21	11.20	11.19	11.20	11.21	11.24	11.24
19,	.	.	10.86	10.86	10.86	10.86	10.86	10.85	10.83	10.83	10.83	10.83	10.83	10.82	10.81	10.81	10.82	10.84	10.85
20,	.	.	10.80	10.79	10.79	10.78	10.78	10.78	10.77	10.76	10.75	10.75	10.75	10.74	10.73	10.73	10.74	10.76	10.76
21,	.	.	10.79	10.78	10.77	10.77	10.77	10.77	10.76	10.75	10.74	10.74	10.74	10.73	10.73	10.73	10.73	10.74	10.75
22,	.	.	10.28	10.28	10.27	10.26	10.26	10.25	10.24	10.23	10.22	10.22	10.22	10.22	10.21	10.21	10.21	10.21	10.21
23,	.	.	10.15	10.14	10.14	10.13	10.12	10.12	10.10	10.10	10.09	10.09	10.09	10.08	10.08	10.07	10.07	10.07	10.08
24,	.	.	10.06	10.06	10.05	10.04	10.04	10.03	10.02	10.02	10.01	10.00	10.00	10.00	10.00	9.99	9.99	9.99	9.98
25,	.	.	10.05	10.05	10.04	10.03	10.02	10.02	10.01	10.01	10.00	9.99	9.99	9.98	9.98	9.98	9.98	9.97	9.97
26,	.	.	10.03	10.03	10.02	10.02	10.02	10.01	10.01	10.00	10.00	9.99	9.99	9.98	9.98	9.97	9.97	9.96	9.96
27,	.	.	10.03	10.02	10.02	10.02	10.02	10.02	10.02	10.01	10.00	10.00	9.99	9.98	9.98	9.97	9.96	9.96	9.96
28,	.	.	9.91	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.89	9.88	9.88	9.87	9.86	9.86	9.85	9.85	9.85
29,	.	.	8.76	8.66	8.67	8.67	8.71	8.74	8.73	8.70	8.63	8.57	8.58	8.65	8.69	8.71	8.70	8.73	8.70
30,	.	.	8.76	8.66	8.65	8.66	8.70	8.74	8.73	8.69	8.66	8.58	8.58	8.65	8.69	8.71	8.70	8.74	8.70
31,	.	.	12.55	12.54	12.60	12.58	12.49	12.49	12.52	12.55	12.57	12.52	12.44	12.50	12.56	12.62	12.69	12.61	12.49
32,	.	.	12.80	12.78	12.82	12.80	12.74	12.74	12.77	12.81	12.85	12.83	12.80	12.82	12.86	12.91	12.95	12.90	12.85
33,	.	.	17.19	17.38	16.88	17.14	17.20	17.18	17.19	17.21	16.84	17.10	17.17	17.21	17.38	17.28	17.15	17.08	17.15
34,	.	.	16.40	16.35	15.99	15.76	15.72	15.72	15.72	15.72	15.71	15.69	15.71	15.71	15.71	15.72	15.72	15.72	15.77

SATURDAY, AUGUST 10, 1861.

STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	12.98	13.00	13.01	13.02	12.98	12.94	12.91	12.89	12.87	12.86	12.85	12.84	12.83	12.83	12.82	12.81	12.81
2, . .	12.83	12.84	12.85	12.86	12.86	12.86	12.87	12.86	12.86	12.86	12.85	12.85	12.84	12.83	12.83	12.82	12.82
3, . .	12.77	12.77	12.78	12.78	—	12.79	12.80	12.80	12.80	12.79	12.79	12.79	12.78	12.78	12.78	12.77	12.77
4, . .	12.74	12.75	12.75	12.76	12.76	12.77	12.77	12.77	12.77	12.76	12.76	12.76	12.76	12.75	12.75	12.75	12.74
5, . .	12.49	12.49	12.49	12.49	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
6, . .	12.48	12.48	12.48	12.48	12.48	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49
7, . .	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.10	12.10	12.10	12.10	12.10	12.10	12.10	12.09
8, . .	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.11	12.10	12.10	12.10	12.10
9, . .	11.90	11.90	11.90	11.90	11.90	11.90	11.90	11.90	11.90	11.90	11.90	11.89	11.89	11.89	11.89	11.89	11.89
10, . .	11.88	11.88	11.88	11.88	11.88	11.88	11.88	11.88	11.88	11.87	11.87	11.87	11.87	11.87	11.87	11.87	11.86
11, . .	11.59	11.59	11.58	11.58	11.58	11.58	11.58	11.58	11.57	11.57	11.56	11.56	11.55	11.55	11.55	11.55	11.55
12, . .	11.56	11.56	11.55	11.55	11.55	11.55	11.55	11.55	11.55	11.54	11.54	11.53	11.53	11.53	11.52	11.52	11.52
13, . .	11.54	11.54	11.54	11.53	11.53	11.53	11.53	11.53	11.52	11.52	11.52	11.52	11.52	11.51	11.51	11.51	11.50
14, . .	11.50	11.50	11.50	11.50	11.49	11.49	11.49	11.49	11.49	11.49	11.49	11.49	11.48	11.48	11.47	11.47	11.47
15, . .	11.45	11.44	11.44	11.44	11.44	11.44	11.43	11.43	11.43	11.44	11.44	11.43	11.43	11.42	11.41	11.40	11.40
16, . .	11.44	11.43	11.43	11.43	11.42	11.42	11.42	11.41	11.42	11.42	11.42	11.42	11.42	11.40	11.39	11.38	11.38
17, . .	11.18	11.18	11.17	11.17	11.17	11.15	11.15	11.16	11.17	11.18	11.18	11.16	11.14	11.11	11.10	11.10	11.08

APPENDIX.

[Jan.



18,	.	.	11.20	11.19	11.19	11.19	11.18	11.17	11.17	11.18	11.19	11.20	11.20	11.18	11.15	11.11	11.10	11.10	11.10
19,	.	.	10.81	10.81	10.80	10.80	10.79	10.78	10.77	10.78	10.79	10.79	10.79	10.79	10.77	10.74	10.73	10.72	10.72
20,	.	.	10.73	10.73	10.73	10.72	10.72	10.71	10.70	10.70	10.71	10.72	10.72	10.71	10.69	10.67	10.66	10.65	10.64
21,	.	.	10.73	10.72	10.72	10.72	10.71	10.70	10.70	10.70	10.70	10.71	10.72	10.71	10.69	10.67	10.65	10.65	10.63
22,	.	.	10.18	10.18	10.18	10.18	10.18	10.17	10.17	10.17	10.17	10.17	10.17	10.16	10.15	10.14	10.13	10.13	10.12
23,	.	.	10.05	10.05	10.05	10.05	10.04	10.04	10.04	10.04	10.04	10.04	10.03	10.02	10.01	10.01	10.00	10.00	10.00
24,	.	.	9.97	9.97	9.96	9.96	9.95	9.96	9.95	9.96	9.95	9.95	9.94	9.93	9.93	9.93	9.93	9.92	9.92
25,	.	.	9.95	9.95	9.95	9.95	9.94	9.94	9.94	9.94	9.94	9.93	9.92	9.92	9.92	9.92	9.91	9.91	9.91
26,	.	.	9.95	9.95	9.95	9.94	9.94	9.94	9.93	9.93	9.92	9.92	9.92	9.92	9.91	9.91	9.91	9.90	9.90
27,	.	.	9.94	9.94	9.94	9.94	9.94	9.93	9.94	9.93	9.93	9.93	9.94	9.94	9.94	9.93	9.93	9.93	9.92
28,	.	.	9.83	9.83	9.83	9.83	9.83	9.82	9.82	9.82	9.82	9.82	9.82	9.83	9.83	9.82	9.82	9.82	9.81
29,	.	.	—	8.57	8.64	8.65	8.67	8.62	8.61	8.60	8.59	8.60	8.62	8.64	8.63	8.65	8.73	8.66	8.63
30,	.	.	—	8.57	8.66	8.66	8.67	8.63	8.61	8.59	8.60	8.61	—	8.63	8.63	8.65	8.73	8.67	8.63
31,	.	.	12.51	12.50	12.54	12.49	12.41	12.50	12.55	12.58	12.62	12.59	12.44	12.34	12.28	12.29	12.30	12.34	12.39
32,	.	.	12.79	12.75	12.77	12.73	12.72	12.80	12.85	12.89	12.93	12.92	12.87	12.86	12.87	12.87	12.87	12.87	12.87
33,	.	.	17.15	17.36	16.81	17.13	17.21	17.22	17.20	17.27	16.82	16.51	16.57	16.69	16.72	16.70	16.85	17.30	17.03
34,	.	.	16.26	16.31	16.00	15.80	15.78	15.78	15.77	15.76	15.75	15.75	15.75	15.75	15.75	15.74	15.78	16.31	16.42

SUNDAY, AUGUST 11, 1861.

STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	12.88	12.86	12.85	12.84	12.83	12.83	12.81	12.80	12.80	12.80	12.79	12.79	12.78	12.78	12.77	12.76	12.75
2, . .	12.85	12.85	12.85	12.84	12.83	12.82	12.81	12.81	12.80	12.80	12.80	12.79	12.79	12.79	12.78	12.77	12.77
3, . .	12.79	12.79	12.79	12.78	12.78	12.78	12.77	12.77	12.77	12.76	12.76	12.75	12.74	12.73	12.73	12.72	12.72
4, . .	12.76	12.76	12.76	12.75	12.75	12.74	12.74	12.73	12.73	12.72	12.72	12.71	12.71	12.71	12.70	12.70	12.70
5, . .	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.49	12.49	12.49	12.48	12.48	12.48	12.47	12.47
6, . .	12.49	12.49	12.49	12.49	12.49	12.48	12.48	12.48	12.47	12.47	12.47	12.47	12.47	12.47	12.46	12.46	12.46
7, . .	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.08	12.08	12.08	12.08	12.08	12.08	12.08
8, . .	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.09	12.08	12.08	12.08	12.08	12.08
9, . .	11.87	11.87	11.87	11.87	11.87	11.88	11.88	11.88	11.88	11.88	11.88	11.88	11.88	11.88	11.87	11.87	11.87
10, . .	11.85	11.85	11.85	11.85	11.85	11.86	11.86	11.86	11.86	11.85	11.85	11.85	11.85	11.85	11.85	11.85	11.85
11, . .	11.53	11.53	11.54	11.54	11.54	11.55	11.55	11.55	11.55	11.55	11.55	11.55	11.55	11.55	11.54	11.53	11.53
12, . .	11.51	11.51	11.51	11.51	11.51	11.51	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.51	11.51	11.50
13, . .	11.49	11.49	11.49	11.49	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	-
14, . .	11.47	11.47	11.47	11.46	11.46	11.46	11.46	11.46	11.46	11.46	11.46	11.46	11.45	11.45	11.45	11.45	-
15, . .	-	11.42	11.42	11.42	11.41	11.41	11.41	11.41	11.41	11.41	11.41	11.40	11.40	11.40	11.40	11.40	-
16, . .	-	11.41	11.41	11.40	11.40	11.39	11.39	11.39	11.39	11.39	11.39	11.38	11.38	11.38	11.38	11.38	-
17, . .	-	11.20	11.19	11.19	11.18	11.17	11.17	11.17	11.18	11.17	11.17	11.15	11.14	11.13	11.12	11.12	-

APPENDIX.

[Jan.

18,	.	.	—	11.23	11.22	11.21	11.20	11.19	11.20	11.20	11.20	11.19	11.19	11.17	11.16	11.15	11.14	11.13	—
19,	.	.	—	10.82	10.81	10.81	10.81	10.81	10.80	10.80	10.80	10.80	10.79	10.78	10.77	10.76	10.76	10.75	—
20,	.	.	10.73	10.73	10.73	10.73	10.73	10.73	10.72	10.72	10.72	10.72	10.72	10.71	10.70	10.69	10.68	10.67	—
21,	.	.	10.72	10.72	10.73	10.73	10.72	10.72	10.70	10.71	10.71	10.71	10.71	10.70	10.69	10.68	10.67	10.66	10.65
22,	.	.	10.15	10.15	10.16	10.17	10.18	10.18	10.17	10.17	10.17	10.17	10.16	10.16	10.15	10.15	10.14	10.13	—
23,	.	.	10.00	10.00	10.00	10.02	10.04	10.04	10.04	10.04	10.04	10.04	10.02	10.04	10.02	10.01	10.00	10.00	10.00
24,	.	.	9.90	9.90	9.91	9.93	9.94	9.94	9.95	9.94	9.95	9.95	9.95	9.95	9.95	9.93	9.92	9.92	9.92
25,	.	.	9.89	9.89	9.90	9.91	9.92	9.93	9.94	9.94	9.93	9.93	9.93	9.93	9.92	9.91	9.91	9.90	—
26,	.	.	9.89	9.89	9.89	9.87	9.89	9.90	9.90	9.89	9.90	9.90	9.00	9.90	9.90	9.90	9.90	9.90	9.90
27,	.	.	9.88	9.88	9.88	9.87	9.86	9.87	9.86	9.86	9.87	9.87	9.89	9.89	9.89	9.90	9.90	9.91	9.90
28,	.	.	—	9.78	9.77	9.77	9.75	9.76	9.76	9.75	9.77	9.77	9.77	9.77	9.78	9.79	9.80	9.80	9.80
29,	.	.	—	8.62	8.62	8.63	8.63	8.61	8.64	8.64	8.66	8.67	8.68	8.67	8.66	8.65	8.65	8.65	8.65
30,	.	.	—	8.62	8.61	8.62	8.62	8.60	—	8.63	8.65	8.66	8.67	8.67	8.65	8.64	8.65	8.64	8.64
31,	.	.	12.68	12.66	12.64	12.62	12.60	12.60	12.65	12.65	12.62	12.60	12.56	12.51	12.48	12.46	12.44	12.41	12.40
32,	.	.	12.87	12.84	12.82	12.80	12.79	12.78	12.82	12.82	12.79	12.76	12.72	12.68	12.66	12.63	12.62	12.60	12.58
33,	.	.	17.37	17.36	17.35	17.34	17.33	17.45	17.41	17.37	17.31	17.27	17.23	17.20	17.18	17.17	17.15	17.15	17.14
34,	.	.	15.76	15.70	15.69	15.68	15.68	15.68	15.68	15.76	15.79	15.70	15.67	15.67	15.67	15.75	15.66	15.66	15.66

MONDAY, AUGUST 12, 1861.

STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	12.71	12.71	12.71	12.71	12.71	12.71	12.70	12.70	12.69	12.69	12.69	12.69	12.68	12.67	12.67	12.67	12.66
2, . .	12.73	12.72	12.72	12.71	12.71	12.70	12.70	12.70	12.69	12.69	12.69	12.68	12.68	12.68	12.68	12.68	12.67
3, . .	12.68	12.68	12.68	12.67	12.67	12.67	12.66	12.66	12.65	12.65	12.64	12.64	12.64	12.63	12.63	12.62	12.61
4, . .	12.66	12.66	12.65	12.65	12.64	12.64	12.63	12.63	12.63	12.62	12.62	12.62	12.61	12.61	12.60	12.60	12.60
5, . .	12.45	22.45	12.45	12.45	12.45	12.44	12.44	12.44	12.43	12.43	12.42	12.42	12.42	12.41	12.41	12.40	12.40
6, . .	12.44	12.44	12.44	12.44	12.43	12.43	12.43	12.42	12.42	12.41	12.41	12.40	12.40	12.40	12.40	12.29	12.29
7, . .	12.07	12.07	12.06	12.06	12.06	12.06	12.06	12.06	12.05	12.05	12.05	12.05	12.04	12.04	12.04	12.03	12.03
8, . .	12.07	12.07	12.06	12.06	12.06	12.06	12.06	12.06	12.05	12.05	12.05	12.05	12.04	12.04	12.04	12.04	12.03
9, . .	11.85	11.85	11.85	11.85	11.85	11.85	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84	11.84
10, . .	11.83	11.83	11.83	11.82	11.82	11.82	11.82	11.82	11.82	11.82	11.81	11.81	11.81	11.81	11.81	11.81	11.81
11, . .	11.51	11.51	11.51	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.51
12, . .	11.48	11.48	11.48	11.48	11.48	11.47	11.46	11.46	11.47	11.47	11.47	11.47	11.47	11.48	11.48	11.48	11.48
13, . .	11.46	11.46	11.46	11.45	11.45	11.45	11.45	11.45	11.45	11.45	11.46	11.46	11.46	11.46	11.46	11.46	11.47
14, . .	11.43	11.42	11.42	11.41	11.41	11.41	11.41	11.41	11.41	11.42	11.43	11.44	11.44	11.44	11.44	11.44	11.45
15, . .	11.36	11.36	11.35	11.35	11.35	11.35	11.36	11.37	11.38	11.39	11.40	11.39	11.40	11.40	11.41	11.41	11.42
16, . .	11.35	11.34	11.34	11.33	11.33	11.33	11.34	11.35	11.36	11.37	11.38	11.38	11.38	11.39	11.39	11.39	11.40
17, . .	11.07	11.07	11.06	11.05	11.05	11.07	11.12	11.15	11.19	11.20	11.19	11.18	11.18	11.20	11.21	11.23	11.23

18,	.	.	11.08	11.08	11.07	11.06	11.07	11.09	11.15	11.19	11.22	11.23	11.21	11.20	11.21	11.23	11.25	11.26	11.27
19,	.	.	10.70	10.69	10.69	10.68	10.68	10.68	10.73	10.76	10.79	10.81	10.82	10.80	10.80	10.81	10.83	10.83	10.85
20,	.	.	10.63	10.63	10.62	10.60	10.61	10.62	10.64	10.67	10.70	10.72	10.72	10.71	10.71	10.72	10.73	10.75	10.76
21,	.	.	10.62	10.62	10.61	10.61	10.60	10.61	10.63	10.66	10.69	10.71	10.72	10.71	10.70	10.71	10.72	10.73	10.74
22,	.	.	10.10	10.10	10.08	10.08	10.08	10.08	10.09	10.10	10.12	10.14	10.14	10.14	10.14	10.14	10.15	10.15	10.16
23,	.	.	9.97	9.97	9.96	9.96	9.96	9.97	9.96	9.96	9.97	9.98	9.98	9.99	9.99	9.99	9.99	10.00	—
24,	.	.	9.89	9.89	9.89	9.89	9.89	9.89	9.88	9.88	9.88	9.89	9.89	9.90	9.89	9.89	9.89	9.89	9.89
25,	.	.	9.87	9.87	9.87	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.87	9.87	9.87	9.87	9.87	9.87	9.88
26,	.	.	9.87	9.86	9.86	9.86	9.86	9.86	9.85	9.85	9.85	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86
27,	.	.	9.87	9.87	9.87	9.85	9.85	9.84	9.85	9.85	9.84	9.84	9.85	9.85	9.86	9.86	9.87	9.87	9.88
28,	.	.	9.77	9.77	9.76	9.75	9.74	9.74	9.75	9.74	9.74	9.74	9.74	9.74	9.75	9.76	9.76	9.76	9.77
29,	.	.	8.58	7.70	7.25	7.28	7.30	7.30	7.28	7.28	7.28	7.28	7.27	7.27	7.29	7.30	7.29	7.29	7.30
30,	.	.	8.57	7.67	7.22	7.25	7.28	7.27	7.25	7.25	7.25	7.25	7.24	7.25	7.25	7.26	7.26	7.26	7.27
31,	.	.	12.36	12.33	12.26	12.42	12.52	12.71	12.78	12.80	12.81	12.69	12.64	12.74	12.79	12.83	12.85	12.80	12.61
32,	.	.	12.57	12.55	12.57	12.70	12.80	12.96	13.02	13.06	13.07	12.99	12.99	13.06	13.10	13.13	13.15	13.12	13.04
33,	.	.	16.71	17.19	16.90	17.46	17.51	17.51	17.49	17.49	16.85	17.39	17.35	17.43	17.46	17.46	17.41	16.52	16.38
34,	.	.	15.72	15.72	15.72	15.70	15.70	15.70	15.71	15.71	15.70	15.69	15.70	15.70	15.70	15.70	15.70	15.68	—

FRIDAY, AUGUST 30, 1861.

STATIONS.	HOURS—A. M.								HOURS—P. M.								
	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1, . .	13.30	13.30	13.31	13.30	13.24	13.19	13.15	13.13	13.11	13.09	13.08	13.07	13.06	13.05	13.05	13.05	13.05
2, . .	13.09	13.09	13.10	13.10	13.10	13.10	—	13.08	13.08	13.07	13.06	13.06	13.05	13.05	13.04	13.03	13.03
3, . .	13.03	13.03	13.03	13.04	13.04	13.04	13.04	13.03	13.03	13.02	13.01	13.01	13.01	13.00	13.00	12.99	12.99
4, . .	12.99	12.99	12.99	12.99	12.99	12.99	12.99	12.98	12.98	12.98	12.97	12.97	12.96	12.96	12.95	12.95	12.95
5, . .	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.75
6, . .	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.74	12.74	12.74	12.74	12.74	12.74	12.74
7, . .	12.26	12.26	12.25	12.25	12.25	12.25	12.25	12.24	12.24	12.24	12.23	12.23	12.23	12.23	12.23	12.23	12.23
8, . .	12.24	12.24	12.24	12.24	12.24	12.23	12.23	12.23	12.23	12.23	12.22	12.22	12.22	12.22	12.22	12.22	12.22
9, . .	11.99	11.99	11.98	11.98	11.98	11.97	11.97	11.97	11.97	11.97	11.96	11.96	11.96	11.96	11.96	11.96	—
10, . .	11.96	11.95	11.95	11.95	11.95	11.94	11.94	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93
11, . .	11.59	11.58	11.58	11.57	11.57	11.56	11.55	11.55	11.55	11.55	11.55	11.55	11.57	11.56	11.56	11.57	11.57
12, . .	11.55	11.54	11.54	11.53	11.53	11.52	11.52	11.51	11.51	11.51	11.51	11.51	11.52	11.52	11.52	11.52	11.53
13, . .	11.52	11.52	11.51	11.50	11.49	11.48	11.48	11.48	11.48	11.48	11.49	11.50	11.51	11.50	11.50	11.50	11.51
14, . .	11.46	11.46	11.45	11.44	11.43	11.43	11.43	11.43	11.44	11.45	11.46	11.46	11.45	11.46	11.46	11.47	11.47
15, . .	11.39	11.38	11.37	11.36	11.36	11.36	11.37	11.38	11.40	11.41	11.42	11.41	11.41	11.43	11.43	11.44	11.45
16, . .	11.36	11.36	11.35	11.34	11.33	11.34	11.35	11.36	11.37	11.38	11.39	11.39	11.38	11.40	11.40	11.41	11.41
17, . .	11.04	11.02	11.01	11.00	11.02	11.05	11.10	11.14	11.17	11.19	11.19	11.18	11.20	11.22	11.22	11.24	11.24

APPENDIX.

[Jan.

18,	.	.	11.02	11.01	11.00	10.99	11.02	11.06	11.11	11.16	11.19	11.21	11.20	11.19	11.21	11.24	11.26	11.27	11.25
19,	.	.	10.78	10.78	10.70	10.65	10.66	10.68	10.72	10.76	10.79	10.81	10.82	10.81	10.81	10.83	10.84	10.86	10.86
20,	.	.	10.62	10.61	10.60	10.59	10.59	10.61	10.64	10.67	10.70	10.72	10.73	10.72	10.73	10.74	10.76	10.77	10.77
21,	.	.	10.61	10.60	10.59	10.58	10.58	10.60	10.63	10.67	10.69	10.72	10.72	10.72	10.72	10.73	10.75	10.76	10.76
22,	.	.	10.16	10.15	10.14	10.13	10.13	10.13	10.14	10.16	10.16	10.17	10.18	10.18	10.19	10.19	10.20	10.20	10.20
23,	.	.	10.00	10.00	9.99	9.99	9.99	9.98	9.99	9.99	9.99	10.00	9.99	9.99	10.01	10.01	10.01	10.01	10.02
24,	.	.	9.94	9.93	9.92	9.92	9.92	9.91	9.91	9.90	9.90	9.90	9.90	9.90	9.93	9.90	9.90	9.91	9.91
25,	.	.	9.93	9.92	9.91	9.91	9.90	9.90	9.89	9.88	9.88	9.88	9.88	9.88	9.90	9.88	9.89	9.89	—
26,	.	.	9.92	9.91	9.91	9.90	9.89	9.88	9.87	9.87	9.87	9.87	9.88	9.88	9.88	9.88	9.88	9.88	—
27,	.	.	9.91	9.90	9.89	9.89	9.87	9.87	9.86	9.86	9.86	9.86	9.87	9.87	9.86	9.88	9.88	9.89	9.89
28,	.	.	9.77	9.76	9.75	9.74	9.73	9.73	9.72	9.71	9.72	9.72	9.73	9.74	9.72	9.74	9.74	9.74	9.74
29,	.	.	7.31	7.28	7.25	7.31	7.35	7.38	7.38	7.38	7.37	7.37	7.38	7.39	7.36	7.37	7.39	7.42	7.39
30,	.	.	7.27	7.24	7.21	7.27	7.32	7.34	7.35	7.34	7.34	7.34	7.35	7.36	7.32	7.33	7.36	7.39	7.34
31,	.	.	11.88	11.87	11.89	12.25	12.41	12.58	12.65	12.69	12.73	12.62	12.59	12.72	12.79	12.81	12.80	12.61	12.43
32,	.	.	12.52	12.50	12.48	12.52	12.64	12.77	12.84	12.89	12.94	12.85	12.86	12.97	13.03	13.06	13.04	12.91	12.83
33,	.	.	16.48	17.31	16.63	17.60	17.47	17.47	17.49	17.51	16.60	17.49	17.53	17.53	17.54	17.50	16.64	16.50	16.32
34,	.	.	16.46	16.42	16.03	15.78	15.76	15.77	15.77	15.76	15.75	15.75	15.76	15.75	15.75	15.90	15.84	15.72	15.69

EXTRA OBSERVATIONS.

November 2d, 3d and 4th, 1861.

	Hour.	Height.		Hour.	Height.
Station No. 2.			Station No. 5.		
November 2, . .	7.05 p.m.	11.93	November 2, . .	6.00 p.m.	11.74
November 3, . .	9.20 a.m.	12.18	November 3, . .	3.10	12.15
	11.00	12.25		3.25	12.15
	12.00	12.26		10.07	12.16
	1.00 p.m.	12.27		10.15	12.16
	2.00	12.28		10.30	12.16
	3.00	12.29		10.45	12.16
	4.00	12.30		11.00	12.17
	5.00	12.31	November 4, . .	2.10 a.m.	12.17
	6.00	12.32		2.30	12.17
	7.00	12.32		2.45	12.17
November 4, . .	5.00 a.m.	12.32		3.00	12.17
	6.00	12.30		6.25	12.17
	7.00	12.29		6.45	12.17
	7.50	12.29		7.00	12.17
	8.00	12.31		11.20	12.21
	9.00	12.33		11.45	12.23
	10.00	12.38		12.00	12.23
	11.00	12.44		4.15 p.m.	12.33
	12.00	12.47	Station No. 6.		
	1.00 p.m.	12.51	November 2, . .	5.25	11.69
	2.00	12.55	November 3, . .	12.53	12.13
	3.00	12.58		1.15	12.12
	4.00	12.60		1.30	12.12
	5.00	12.64		1.45	12.13
Station No. 3.				2.00	12.13
November 2, . .	6.50	11.88		2.15	12.13
November 3, . .	11.30 a.m.	12.22		2.30	12.13
	12.30 p.m.	12.23		2.45	12.13
	1.30	12.24		11.20	12.20
	2.30	12.25		11.30	12.20
	3.30	12.26		11.45	12.20
	4.30	12.27		12.00	12.20
	5.30	12.28	November 4, . .	12.45 a.m.	12.17
	6.30	12.285		1.00	12.17
November 4, . .	5.30 a.m.	12.28		1.15	12.17
	6.30	12.27		1.30	12.17
	7.30	12.26		1.45	12.17
	8.00	12.27		3.25	12.16
	8.30	12.29		3.45	12.16
	9.30	12.32		4.00	12.16
	10.30	12.36		4.20	12.16
	11.30	12.39		4.40	12.165
	12.30 p.m.	12.42		5.00	12.16
	1.30	12.45		5.20	11.16
	2.30	12.50		5.40	12.16
	3.30	12.53		6.00	12.17
	4.30	12.55		7.25	12.16



## EXTRA OBSERVATIONS—Continued.

*November 2d, 3d and 4th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 6.—Con.</b>			<b>Station 10.—Con.</b>		
November 4, . .	7.45 <i>a.m.</i>	12.16	November 4, . .	7.00 <i>a.m.</i>	11.74
	8.00	12.16		8.00	11.75
	8.15	12.16		8.30	11.75
	8.30	12.16		9.00	11.75
	8.45	12.16		9.30	11.75
	9.00	12.155		9.45	11.75
	9.15	12.165		10.00	11.76
	9.35	12.16		10.30	11.76
	10.00	12.175		11.00	11.77
	10.15	12.185		11.30	11.78
	10.25	12.19		12.00	11.78
	10.35	12.19		12.30 <i>p.m.</i>	11.79
	10.45	12.19		1.00	11.80
	12.27 <i>p.m.</i>	12.23		1.30	11.81
	12.45	12.24		2.00	11.82
	1.00	12.25		2.30	11.84
	1.15	12.25		3.00	11.85
	1.30	12.26		3.30	11.86
	1.45	12.26		4.00	11.87
	2.00	12.26	<b>Station No. 11.</b>		
	2.30	12.28	November 2, . .	4.20	11.12
	2.45	12.29	November 3, . .	1.30	11.41
	3.00	12.29		2.00	11.42
<b>Station No. 10.</b>				2.30	11.42
November 2, . .	4.38	11.23		3.00	11.43
November 3, . .	1.30	11.58		3.30	11.43
	2.00	11.58		4.00	11.44
	2.30	11.59		4.30	11.44
	3.00	11.59		5.00	11.45
	3.30	11.60		5.30	11.46
	4.00	11.60		6.00	11.46
	4.30	11.61		6.30	11.48
	5.00	11.61		7.30	11.51
	5.30	11.62		8.30	11.53
	6.00	11.62		9.30	11.55
	6.30	11.63		10.30	11.56
	7.00	11.64		11.30	11.57
	8.00	11.66	November 4, . .	12.30 <i>a.m.</i>	11.58
	9.00	11.67		1.30	11.59
	10.00	11.68		2.30	11.59
	11.00	11.70		3.30	11.60
	12.00	11.70		4.30	11.61
November 4, . .	1.00 <i>a.m.</i>	11.69		5.30	11.63
	2.00	11.71		6.30	11.64
	3.00	11.71		7.30	11.64
	4.00	11.71		8.30	11.65
	5.00	11.72		9.00	11.65
	6.00	11.73		9.30	11.66

## EXTRA OBSERVATIONS—Continued.

November 2d, 3d and 4th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station 11.—Con.</b>			<b>Station 18.—Con.</b>		
November 4, . .	10.00 <i>a.m.</i>	11.67	November 3, . .	1.50 <i>p.m.</i>	11.17
	10.30	11.67		3.20	11.19
	11.00	11.68		4.16	11.21
	11.30	11.68		7.07	11.28
	12.00	11.69		7.55	11.31
	12.30 <i>p.m.</i>	11.70		8.47	11.34
	1.00	11.72		9.30	11.37
	1.30	11.73	November 4, . .	8.42 <i>a.m.</i>	11.56
	2.00	11.75		9.15	11.58
	2.30	11.77		10.30	11.60
	3.00	11.78		11.07	11.67
	3.30	11.78		1.55 <i>p.m.</i>	11.75
	4.00	11.79		3.10	11.77
				4.00	11.79
<b>Station No. 16.</b>			<b>Station No. 19.</b>		
November 2, . .	12.00	11.00	November 2, . .	11.40	10.76
November 3, . .	9.00 <i>a.m.</i>	11.14	November 3, . .	9.30 <i>a.m.</i>	10.81
	1.05 <i>p.m.</i>	11.22		10.21	10.82
	3.45	11.30		10.50	10.85
	5.10	11.33		12.35 <i>p.m.</i>	10.86
	6.45	11.36		2.00	10.88
	8.20	11.38		3.15	10.92
November 4, . .	9.00 <i>a.m.</i>	11.57		4.25	10.95
	10.45	11.61		4.50	10.76
	2.14 <i>p.m.</i>	11.76		7.13	11.01
	3.39	11.72		7.40	11.03
<b>Station No. 17.</b>				8.03	11.06
November 2, . .	11.55	10.91		9.15	11.07
November 3, . .	12.50	11.12		10.05	11.08
	1.25	11.13	November 4, . .	7.50 <i>a.m.</i>	11.21
	3.35	11.19		8.25	11.23
	5.05	11.22		9.40	11.27
	7.00	11.26		10.15	11.30
	8.00	11.30		11.25	11.35
	8.40	11.33		11.55	11.37
	9.35	11.35		1.17 <i>p.m.</i>	11.37
November 4, . .	8.50 <i>a.m.</i>	11.54		1.45	11.42
	9.50	11.55		2.45	11.44
	10.35	11.60		3.06	11.45
	11.00	11.61		4.08	11.48
	2.00 <i>p.m.</i>	11.69		4.40	11.50
	2.55	11.70	<b>Station No. 20.</b>		
	3.22	11.71	November 2, . .	5.51	10.765
	3.58	11.73		9.38	10.76
<b>Station No. 18.</b>				9.50	10.76
November 2, . .	6.03	11.04		10.15	10.765
November 3, . .	9.18 <i>a.m.</i>	11.12		10.35	10.77
	10.35	11.14		10.50	10.78
	12.45 <i>p.m.</i>	11.15			

## EXTRA OBSERVATIONS—Continued.

*November 2d, 3d and 4th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 20.—Con.</b>			<b>Station 21.—Con.</b>		
November 2, . .	11.05 <i>p.m.</i>	10.78	November 4, . .	9.00 <i>a.m.</i>	11.12
	11.25	10.75		9.20	11.13
November 3, . .	9.45 <i>a.m.</i>	10.76		9.40	11.14
	11.00	10.78		10.00	11.16
	12.20 <i>p.m.</i>	10.80		10.20	11.18
	2.12	10.83		10.40	11.18
	4.37	10.85		11.00	11.20
	7.37	10.89		11.20	11.21
	9.05	11.19		11.40	11.22
November 4, . .	8.00 <i>a.m.</i>	11.16		12.00	11.23
	10.00	11.20	<b>Station No. 22.</b>		
	11.30	11.27	November 3, . .	11.30	10.46
	1.30 <i>p.m.</i>	11.33		1.33 <i>p.m.</i>	10.47
	2.48	11.37		1.50	10.48
	4.18	11.39		2.05	10.48
	4.35	11.41		2.25	10.49
<b>Station No. 21.</b>				2.45	10.48
November 3, . .	11.25 <i>a.m.</i>	10.77		3.15	10.49
	11.56	10.78		3.45	10.52
	1.24 <i>p.m.</i>	10.80		4.30	10.55
	1.40	10.79		5.00	10.54
	1.58	10.79		5.20	10.55
	2.15	10.80		5.40	10.55
	2.35	10.80		6.00	10.56
	3.00	10.81		6.30	10.56
	3.30	10.83		7.00	10.57
	4.00	10.84		7.30	10.57
	4.45	10.86		8.00	10.59
	5.10	10.87		8.30	10.60
	5.30	10.87		9.00	10.61
	5.50	10.88		9.30	10.62
	6.15	10.88		10.00	10.63
	6.45	10.89	November 4, . .	5.00 <i>a.m.</i>	10.72
	7.15	10.89		5.30	10.73
	7.45	10.91		6.00	10.74
	8.15	10.92		6.20	10.75
	8.45	10.92		6.40	10.75
	9.15	10.93		7.00	10.76
	9.45	10.93		7.50	10.78
November 4, . .	5.15 <i>a.m.</i>	11.05		8.10	10.79
	5.46	11.06		8.30	10.79
	6.10	11.06		8.50	10.81
	6.30	11.07		9.10	10.82
	6.50	11.07		9.30	10.83
	7.40	11.09		9.50	10.84
	8.00	11.09		10.10	10.86
	8.20	11.10		10.30	10.87
	8.40	11.11		10.50	10.88

EXTRA OBSERVATIONS—Continued.  
November 2d, 3d and 4th, 1861.

	Hour.	Height.		Hour.	Height.
Station 22.—Con.			Station 28.—Con.		
November 4, . .	11.10 a.m.	10.89	November 2, . .	11.00 p.m.	10.06
	11.30	10.89		11.10	10.055
	11.50	10.90		11.20	10.053
Station No. 28.				11.28	10.055
November 2, . .	6.30 p.m.	10.31	November 3, . .	12.10 a.m.	10.03
	6.35	10.295		1.20	10.02
	6.40	10.28		1.30	10.015
	6.45	10.275		9.35	10.078
	6.50	10.272		9.45	10.075
	6.55	10.267		9.55	10.07
	7.00	10.255		10.00	10.07
	7.05	10.25		10.30	10.077
	7.10	10.235		10.58	10.09
	7.15	10.23		11.05	10.09
	7.21	10.22		11.10	10.09
	7.25	10.21		11.15	10.09
	7.30	10.20		11.20	10.09
	7.35	10.19		11.25	10.093
	7.40	10.18		11.30	10.093
	7.45	10.17		11.35	10.093
	7.50	10.168		11.40	10.093
	7.55	10.16		11.45	10.095
	8.00	10.158		11.50	10.095
	8.05	10.16		11.55	10.093
	8.10	10.15		12.00	10.093
	8.10	10.145		12.05 p.m.	10.094
	8.20	10.138		12.10	10.095
	8.30	10.13		12.15	10.097
	9.00	10.09		12.20	10.098
	9.05	10.085		12.40	10.095
	9.10	10.08		12.45	10.092
	9.15	10.078		12.50	10.092
	9.20	10.078		12.55	10.093
	9.25	10.08		1.00	10.093
	9.30	10.09		1.05	10.093
	9.35	10.08		1.10	10.095
	9.40	10.075		1.15	10.095
	9.50	10.08		1.20	10.095
	9.55	10.178		1.25	10.097
	10.00	10.075		1.30	10.097
	10.05	10.07		1.35	10.10
	10.15	10.078		1.40	10.10
	10.20	10.08		1.45	10.10
	10.25	10.08		1.50	10.10
	10.30	10.078		1.55	10.10
	10.35	10.078		2.06	10.10
	10.40	10.07		2.10	10.10
	10.50	10.068		2.15	10.102

## EXTRA OBSERVATIONS—Continued.

*November 2d, 3d and 4th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 28.—Con.</b>			<b>Station 28.—Con.</b>		
November 3, . .	2.20 <i>p.m.</i>	10.105	November 3, . .	7.00 <i>p.m.</i>	10.17
	2.25	10.107		7.05	10.17
	2.30	10.11		7.10	10.17
	2.35	10.12		7.20	10.17
	2.50	10.13		7.30	10.17
	2.55	10.13		7.45	10.17
	3.00	10.135		7.50	10.165
	3.05	10.14		7.55	10.165
	3.10	10.14		8.00	10.165
	3.15	10.14		8.05	10.163
	3.20	10.138		8.10	10.165
	3.25	10.135		8.15	10.167
	3.30	10.132		8.45	10.175
	3.35	10.132		8.50	10.177
	3.40	10.132		8.55	10.175
	3.45	10.135		9.00	10.175
	3.50	10.135		9.05	10.175
	3.55	10.133		9.15	10.178
	4.00	10.133		9.20	10.18
	4.05	10.13		9.25	10.18
	4.10	10.128		9.30	10.18
	4.15	10.125		9.35	10.182
	4.20	10.122		9.50	10.185
	4.35	10.125		9.53	10.185
	4.40	10.125		10.00	10.187
	4.45	10.128		10.05	10.19
	4.50	10.13		10.10	10.195
	4.55	10.13		10.15	10.193
	5.00	10.132		10.20	10.195
	5.05	10.135		10.25	10.195
	5.10	10.138		10.30	10.197
	5.15	10.14		10.35	10.205
	5.40	10.15		10.40	10.20
	5.45	10.155		10.35	10.207
	5.50	10.16		10.50	10.21
	5.55	10.16		10.55	10.21
	6.00	10.16		11.00	10.213
	6.05	10.163		11.10	10.22
	6.10	10.165		11.15	10.22
	6.15	10.167		11.20	10.22
	6.20	10.167		11.25	10.22
	6.25	10.17		11.30	10.218
	6.30	10.17		11.35	10.218
	6.35	10.17		11.40	10.218
	6.40	10.172		11.45	10.218
	6.45	10.17		11.50	10.218
	6.50	10.17		11.55	10.218
	6.55	10.17		12.00	10.218

EXTRA OBSERVATIONS—Continued.

November 2d, 3d and 4th, 1861.

	Hour.	Height.		Hour.	Height.
Station 28.—Con. November 4, . .	12.05 a.m.	10.218	Station 28.—Con. November 4, . .	4.45 a.m.	10.28
	12.10	10.218		4.50	10.28
	12.15	10.22		4.55	10.28
	12.20	10.22		5.00	10.28
	12.25	10.222		5.05	10.28
	12.30	10.228		5.10	10.283
	12.35	10.228		5.15	10.29
	12.40	10.23		5.20	10.293
	12.45	10.23		5.25	10.295
	12.50	10.23		5.30	10.30
	12.55	10.23		5.35	10.31
	1.00	10.232		5.40	10.32
	1.10	10.235		5.45	10.325
	1.15	10.24		5.50	10.33
	1.20	10.24		5.55	10.34
	1.25	10.24		6.00	10.35
	1.30	10.24		6.05	10.355
	1.35	10.24		6.10	10.36
	1.40	10.24		6.15	10.37
	1.45	10.24		12.28 p.m.	10.60
	1.50	10.24		3.52	10.665
	1.55	10.24	Station No. 30. November 2, . .	3.35	10.12
	2.00	10.24		5.40	10.20
	2.30	10.245		6.00	10.18
	2.35	10.25		6.20	10.17
	2.40	10.25		6.25	10.13
	2.45	10.25		6.32	10.10
	2.50	10.25		6.50	9.95
	3.05	10.252		7.00	9.88
	3.10	10.255		7.08	9.81
	3.15	10.255		7.15	9.70
	3.20	10.258		7.20	9.62
	3.25	10.26		7.30	9.48
	3.30	10.26		7.35	9.42
	3.35	10.26		7.43	9.33
	3.40	10.26		7.50	9.24
	3.45	10.265		7.55	9.20
	3.50	10.268		8.01	9.14
	3.55	10.27		8.10	9.07
	4.00	10.27		8.15	9.03
	4.05	10.27		8.21	8.99
	4.10	10.275		8.26	8.95
	4.15	10.272		8.30	8.92
	4.20	10.272		8.35	8.89
	4.25	10.272		8.40	8.86
	4.30	10.272		8.45	8.82
	4.35	10.278		9.05	8.71
	4.40	10.28			

## EXTRA OBSERVATIONS—Continued.

*November 2d, 3d and 4th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 30.—Con.</b>			<b>Station 30.—Con.</b>		
November 2, . .	9.10 <i>p.m.</i>	8.68	November 3, . .	2.10 <i>p.m.</i>	8.73
	9.15	8.66		2.15	8.76
	9.20	8.63		2.20	8.79
	9.41	8.61		2.25	8.82
	9.55	8.63		2.30	8.85
	10.02	8.64		2.35	8.87
	10.12	8.66		2.40	8.90
	10.23	8.67		2.45	8.925
	10.32	8.67		2.50	8.95
	10.40	8.67		2.55	8.97
	10.47	8.68		3.01	9.00
	10.58	8.685		3.05	9.00
	11.03	8.685		3.10	9.00
November 3, . .	1.27 <i>a.m.</i>	8.69		3.15	9.00
	1.48	8.68		3.21	8.985
	2.10	8.68		3.30	8.97
	2.23	8.67		3.35	8.97
	9.05	8.69		3.40	8.93
	9.40	8.72		3.45	8.88
	11.12	8.79		3.50	8.83
	11.21	8.79		3.55	8.775
	11.26	8.785		4.00	8.71
	11.35	8.76		4.08	8.62
	11.43	8.75		4.10	8.605
	11.52	8.69		4.16	8.54
	11.55	8.66		4.20	8.51
	12.00	8.63		4.25	8.46
	12.05 <i>p.m.</i>	8.59		4.32	8.43
	12.10	8.55		4.38	8.45
	12.17	8.50		4.45	8.49
	12.20	8.48		4.50	8.53
	12.26	8.44		5.00	8.61
	12.31	8.41		5.05	8.66
	12.37	8.375		5.10	8.69
	12.40	8.36		5.21	8.77
	12.47	8.32		5.27	8.81
	1.00	8.26		5.32	8.83
	1.07	8.25		5.35	8.835
	1.10	8.28		5.40	8.845
	1.17	8.33		5.47	8.86
	1.20	8.35		5.51	8.87
	1.26	8.41		6.00	8.87
	1.30	8.45		6.07½	8.87
	1.35	8.48		6.10	8.87
	1.50	8.59		6.15	8.87
	1.55	8.63		6.35	8.89
	2.00	8.67		6.38	8.88
	2.05	8.69		6.53½	8.855

## EXTRA OBSERVATIONS—Continued.

*November 2d, 3d and 4th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 30.—Con.</b>			<b>Station 30.—Con.</b>		
November 3, . .	6.58 <i>p.m.</i>	8.82	November 3, . .	11.49 <i>p.m.</i>	8.76
	7.00	8.805		11.55	8.72
	7.06	8.77		12.00	8.68
	7.10	8.75	November 4, . .	12.05 <i>a.m.</i>	8.65
	7.15	8.72		12.10	8.62
	7.20	8.69		12.26	8.54
	7.25	8.685		12.37	8.515
	7.30	8.64		1.00	8.61
	7.35	8.62		1.07	8.655
	7.40	8.60		1.10	8.67
	7.45	8.58		1.15	8.70
	7.51 $\frac{1}{2}$	8.555		1.21	8.73
	7.55	8.54		1.25	8.75
	8.00	8.52		1.30	8.77
	8.06	8.505		1.35	8.79
	8.10	8.49		1.42	8.83
	8.15	8.48		2.33	9.02
	8.20	8.47		2.47	9.06
	8.34	8.425		2.50	9.11
	8.40	8.40		2.55	9.13
	8.47	8.37		3.00	9.15
	8.50	8.36		3.12	9.20
	8.55	8.34		3.23	9.23
	9.00	8.32		3.30	9.26
	9.15	8.28		3.35	9.26
	9.20	8.27		3.42	9.28
	9.28	8.26		3.55	9.27
	9.30	8.265		3.58	9.27
	9.37	8.27		4.29	9.14
	9.46	8.30		5.08	9.28
	10.00	8.41		12.00	10.20
	10.05	8.46		2.55 <i>p.m.</i>	10.19
	10.11	8.52		3.15	10.20
	10.16	8.57	<b>Station No. 31.</b>		
	10.20	8.60	November 2, . .	6.47	12.16
	10.25	8.65	November 3, . .	4.23 <i>a.m.</i>	12.02
	10.37	8.75		12.30 <i>p.m.</i>	12.12
	10.40	8.765	<b>Station No. 32.</b>		
	10.42 $\frac{1}{2}$	8.77	November 2, . .	6.42	12.51
	10.45	8.78	November 3, . .	11.17 <i>a.m.</i>	12.795
	10.50	8.80		12.25 <i>p.m.</i>	12.83
	10.57 $\frac{1}{2}$	8.80	<b>Station No. 33.</b>		
	11.00	8.80	November 2, . .	7.13	16.96
	11.40	8.80	November 3, . .	12.00 <i>m.</i>	16.76



EXTRA OBSERVATIONS—Continued.

GENERAL.

November 2d, 3d and 4th, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 2, .	30	8.10 <i>a.m.</i>	10.19	Nov. 4, .	2	7.50 <i>a.m.</i>	12.29
	29	8.18	10.19		3	8.00	12.27
	28	8.30	10.34		4	8.15	12.23
	27	8.45	10.40		5	8.30	12.15
	26	10.00	10.33		6	8.40	12.16
	25	10.35	10.36		7	9.00	11.94
	24	10.55	10.38		10	9.45	11.75
	23	11.12	10.39		11	9.55	11.65
	22	11.30	10.49		12	10.10	11.61
	21	11.35	10.69		13	10.55	11.62
	20	1.55 <i>p.m.</i>	10.74		14	11.05	11.61
	19	2.05	10.77		15	11.15	11.65
	18	2.10	10.99		16	11.25	11.62
	17	2.15	10.96		17	11.35	11.62
	16	2.25	10.99		18	11.40	11.69
	15	2.32	11.02		19	11.45	11.36
	14	2.50	11.00		20	11.55	11.28
	13	3.05	10.69		21	1.30 <i>p.m.</i>	11.29
	12	4.00	11.07		22	1.40	11.01
	11	4.20	11.12		23	1.52	10.78
	10	4.30	11.23		24	2.05	10.74
	7	5.20	11.44		25	2.17	10.73
	6	5.45	11.69		26	2.45	10.73
	5	6.00	11.74		27	3.55	10.76
	4	6.15	11.84		28	4.20	10.67
	3	6.50	11.88		29	4.30	10.24
	2	7.05	11.93		30	4.35	10.24

## EXTRA OBSERVATIONS—Continued.

November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station No. 2.</b>			<b>Station 2.—Con.</b>		
November 8, . .	7.00 <i>p.m.</i>	12.80	November 10, .	6.45 <i>p.m.</i>	12.60
	8.00	12.80		7.00	12.60
November 9, . .	5.00 <i>a.m.</i>	12.82		7.15	12.60
	5.15	12.825		7.30	12.60
	5.30	12.83		7.45	12.595
	5.45	12.83		8.00	12.595
	6.00	12.83		8.15	12.595
	6.15	12.83		8.30	12.59
	6.30	12.83		8.45	12.59
	6.45	12.83		9.00	12.59
	7.00	12.83	November 11, .	5.30 <i>a.m.</i>	12.54
	8.10	12.825		5.45	12.535
	12.20 <i>p.m.</i>	12.815		6.00	12.535
	1.30	12.81		6.15	12.53
	4.35	12.82		6.30	12.525
	5.30	12.82		6.45	12.525
	5.45	12.82		7.00	12.525
	6.00	12.82		7.35	12.51
	6.15	12.82		10.30	12.51
	6.30	12.82		11.00	12.51
	6.45	12.815		12.00	12.52
	7.00	12.815		1.25 <i>p.m.</i>	12.53
	7.15	12.81		2.00	12.54
	7.30	12.81		3.00	12.56
	7.46	12.81		4.00	12.57
	8.00	12.81		5.00	12.59
	8.15	12.81	<b>Station No. 3.</b>		
	8.30	12.81	November 9, . .	8.20 <i>a.m.</i>	12.76
	8.45	12.81		12.10 <i>p.m.</i>	12.76
	9.00	12.81		1.40	12.76
November 10, .	4.45 <i>a.m.</i>	12.74		4.40	12.765
	5.00	12.735	November 10, .	8.10 <i>a.m.</i>	12.65
	5.15	12.725		11.45	12.625
	5.30	12.72		1.15 <i>p.m.</i>	12.71
	5.45	12.715		4.05	12.58
	6.00	12.715	November 11, .	7.45 <i>a.m.</i>	12.47
	6.15	12.715		10.05	12.45
	6.30	12.71	<b>Station No. 4.</b>		
	6.45	12.705	November 9, . .	8.30	12.705
	7.00	12.70		12.00	12.70
	8.00	12.69		1.55 <i>p.m.</i>	12.71
	12.00	12.65		4.25	12.71
	1.00 <i>p.m.</i>	12.65	November 10, .	8.25 <i>a.m.</i>	12.605
	4.15	12.62		11.25	12.575
	5.30	12.61		1.25 <i>p.m.</i>	12.56
	5.45	12.61		3.50	12.54
	6.00	12.61	November 11, .	7.55 <i>a.m.</i>	12.42
	6.15	12.605		9.50	12.41
	6.30	12.60			

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station No. 5.</b>			<b>Station 10.—Con.</b>		
November 9, . .	8.40 <i>a.m.</i>	12.575	November 9, . .	6.00 <i>p.m.</i>	11.98
	11.45	12.58	November 10, .	10.00 <i>a.m.</i>	11.92
	2.05 <i>p.m.</i>	12.58		11.00	11.915
	4.10	12.585		12.00	11.90
November 10, .	8.40 <i>a.m.</i>	12.52		1.00 <i>p.m.</i>	11.90
	11.10	12.49		2.00	11.89
	1.35 <i>p.m.</i>	12.47		3.00	11.88
	3.35	12.46		4.00	11.86
November 11, .	8.10 <i>a.m.</i>	12.32		5.00	11.85
	9.40	12.31		6.00	11.84
<b>Station No. 6.</b>				7.00	11.83
November 9, . .	8.50	12.56		8.00	11.82
	11.35	12.56		9.00	11.81
	2.15 <i>p.m.</i>	12.56		10.00	11.80
	4.00	12.565		11.00	11.80
November 10, .	8.50 <i>a.m.</i>	12.50		12.00	11.79
	11.00	12.48	November 11, .	1.00 <i>a.m.</i>	11.78
	2.45 <i>p.m.</i>	12.46		2.00	11.77
	3.25	12.445		3.00	11.76
November 11, .	8.16 <i>a.m.</i>	12.31		4.00	11.75
	9.30	12.30		5.00	11.75
<b>Station No. 7.</b>				6.00	11.74
November 9, . .	9.10	12.24		7.00	11.73
	11.15	12.24		8.00	11.73
	2.35 <i>p.m.</i>	12.25		9.00	11.72
	3.35	12.25		10.00	11.72
November 10, .	9.20 <i>a.m.</i>	12.215		11.00	11.715
	10.30	12.21		12.00	11.715
	2.05 <i>p.m.</i>	12.17		12.30 <i>p.m.</i>	11.71
	3.00	12.16		1.30	11.71
November 11, .	8.30 <i>a.m.</i>	12.00		2.30	11.71
	9.10	12.00		4.00	11.74
<b>Station No. 10.</b>			<b>Station No. 11.</b>		
November 9, . .	5.45	11.98	November 9, . .	6.30 <i>a.m.</i>	11.81
	6.10	11.97		7.30	11.81
	7.00	11.96		8.30	11.80
	8.00	11.96		9.30	11.795
	9.00	11.96		10.30	11.795
	10.00	11.95		11.30	11.81
	11.00	11.95		1.30 <i>p.m.</i>	11.83
	12.00	11.96		2.30	11.84
	12.30 <i>p.m.</i>	11.96		4.30	11.84
	1.00	11.96		5.30	11.84
	2.00	11.97	November 10, .	9.45 <i>a.m.</i>	11.77
	3.00	11.98		10.30	11.77
	3.30	11.98		11.30	11.75
	4.00	11.98		12.30 <i>p.m.</i>	11.74
	5.00	11.98		1.30	11.73

## EXTRA OBSERVATIONS—Continued.

November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station 11.—Con.</b>			<b>Station 16.—Con.</b>		
November 10, .	2.30 <i>p.m.</i>	11.71	November 10, .	4.00 <i>p.m.</i>	11.45
	3.30	11.70		5.30	11.44
	4.30	11.69		7.00	11.43
	5.30	11.68		9.20	11.41
	6.30	11.67		10.57	11.40
	7.30	11.66	November 11, .	12.25 <i>a.m.</i>	11.39
	8.30	11.65		2.22	11.38
	9.30	11.64		4.43	11.37
	10.30	11.63		5.30	11.37
	11.30	11.62		7.00	11.37
November 11, .	12.30 <i>a.m.</i>	11.61		8.30	11.37
	1.30	11.595		10.00	11.39
	2.30	11.59		11.33	11.42
	3.30	11.58		1.00 <i>p.m.</i>	11.44
	4.30	11.57		2.30	11.45
	5.30	11.57		4.28	11.48
	6.30	11.57	<b>Station No. 17.</b>		
	7.30	11.57	November 8, . .	7.25	11.63
	8.30	11.56		6.12 <i>a.m.</i>	11.49
	9.30	11.56	November 9, . .	7.20	11.48
	10.30	11.56		8.43	11.51
	11.30	11.56		10.21	11.53
	1.00 <i>p.m.</i>	11.57		11.42	11.57
	2.00	11.57		1.10 <i>p.m.</i>	11.58
	3.00	11.59		2.55	11.56
	3.15	11.595		4.12	11.57
	3.30	11.60		5.43	11.57
				7.26	11.53
				9.43	11.54
				11.15	11.51
<b>Station No. 16.</b>			November 10, .	5.46 <i>a.m.</i>	11.42
November 8, . .	7.41	11.71		7.40	11.40
	5.45 <i>a.m.</i>	11.60		8.45	11.39
November 9, . .	7.00	11.59		10.12	11.38
	8.30	11.59		11.42	11.36
	10.00	11.61		1.47 <i>p.m.</i>	11.34
	11.30	11.59		2.40	11.34
	1.00 <i>p.m.</i>	11.64		4.08	11.33
	2.30	—		5.41	11.32
	3.05	11.63		7.08	11.31
	4.00	11.64		9.43	11.30
	5.30	11.64		11.08	11.29
	7.00	11.62	November 11, .	12.37 <i>a.m.</i>	11.28
November 10, .	9.30	11.62		2.35	11.27
	5.30 <i>a.m.</i>	11.54		5.00	11.26
	7.00	11.52		5.46	11.26
	8.30	11.51		7.10	11.27
	10.00	11.49		8.45	11.29
	11.30	11.48			
	1.33 <i>p.m.</i>	11.47			
	2.30	11.46			

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 17.—Con.</b>			<b>Station 19.—Con.</b>		
November 11, .	10.09 <i>a.m.</i>	11.32	November 9, .	11.54 <i>a.m.</i>	11.35
	11.42	11.37		1.21 <i>p.m.</i>	11.36
	1.08 <i>p.m.</i>	11.38		2.40	11.36
	2.40	11.39		4.23	11.36
	4.38	11.44		5.58	11.36
<b>Station No. 18.</b>			November 10, .	7.42	11.33
November 8, . .	7.20	11.63		10.00	11.32
November 9, . .	6.10 <i>a.m.</i>	11.49		11.40	11.29
	7.25	11.48		6.03 <i>a.m.</i>	11.20
	8.50	11.51		7.32	11.18
	10.29	11.54		9.01	11.17
	11.47	11.57		10.30	11.15
	1.50 <i>p.m.</i>	11.58		11.51	11.13
	2.50	11.56		2.03 <i>p.m.</i>	11.11
	4.16	11.57		2.50	11.10
	5.49	11.57		4.25	11.09
November 10, .	7.33	11.52	November 11, .	5.51	11.08
	9.53	11.53		7.22	11.07
	11.23	11.50		10.00	11.05
	5.54 <i>a.m.</i>	11.42		11.22	11.04
	7.26	11.40		12.50 <i>a.m.</i>	11.03
	8.52	11.38		2.50	11.02
	10.24	11.37		5.20	11.01
	11.46	11.36		6.02	11.01
	1.56 <i>p.m.</i>	11.34		7.23	11.02
	2.45	11.34	<b>Station No. 20.</b>	9.01	11.03
	4.20	11.33		10.22	11.06
	5.46	11.32		11.54	11.10
	7.14	11.31		1.20 <i>p.m.</i>	11.12
	9.50	11.29		2.54	11.13
November 11, .	11.15	11.29		5.07	11.19
	12.42 <i>a.m.</i>	11.28	November 8, . .	6.50	11.37
	2.42	11.27		6.24 <i>a.m.</i>	11.26
	5.08	11.26		7.38	11.25
	5.54	11.27		9.06	11.27
	7.16	11.28	November 9, . .	10.42	11.29
	8.53	11.30		12.00	11.31
	10.15	11.33		1.27 <i>p.m.</i>	11.32
	11.47	11.39		2.30	11.32
	1.14 <i>p.m.</i>	11.39		4.30	11.31
	2.46	11.40		6.05	11.31
	4.48	11.45		7.50	11.29
<b>Station No. 19.</b>			November 10, .	10.15	11.27
November 8, . .	7.10	11.43		11.53	11.24
November 9, . .	6.20 <i>a.m.</i>	11.30		1.00 <i>a.m.</i>	11.22
	7.31	11.29		2.00	11.20
	9.00	11.31		3.00	11.18
	10.35	11.33			

## EXTRA OBSERVATIONS—Continued.

November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station 20.—Con.</b>			<b>Station 21.—Con.</b>		
November 10, .	4.00 <i>a.m.</i>	11.17	November 9, . .	5.30 <i>p.m.</i>	11.26
	6.10	11.13		5.50	11.26
	7.41	11.11		6.10	11.26
	9.08	11.10		6.30	11.27
	10.36	11.09		6.50	11.27
	11.57	11.07		7.10	11.27
	2.08 <i>p.m.</i>	11.04		7.30	11.26
	2.57	11.04		7.50	11.25
	4.31	11.03		8.10	11.24
	5.08	11.02		8.30	11.24
	7.30	11.00		8.50	11.24
	10.10	10.98		9.10	11.24
	11.33	10.97		9.30	11.24
				9.50	11.24
November 11, .	1.00 <i>a.m.</i>	10.96	November 10, .	5.00 <i>a.m.</i>	11.13
	3.02	10.95		5.20	11.12
	5.30	10.94		5.40	11.11
	6.10	10.94		6.00	11.11
	7.29	10.95		6.20	11.10
	9.09	10.96		6.40	11.10
	10.28	10.99		7.00	11.09
	12.00	11.04		7.20	11.09
	1.29 <i>p.m.</i>	11.06		7.40	11.08
	3.10	11.07		8.00	11.08
	5.09	11.12		8.20	11.08
				8.40	11.08
				9.00	11.08
				9.20	11.07
				9.40	11.07
<b>Station No. 21.</b>				10.00	11.07
November 9, . .	9.30 <i>a.m.</i>	11.24		10.20	11.07
	9.50	11.24		10.40	11.06
	10.10	11.24		11.00	11.05
	10.30	11.25		11.20	11.05
	10.50	11.25		11.40	11.05
	11.10	11.25		12.00	11.04
	11.30	11.26		12.20 <i>p.m.</i>	11.03
	11.50	11.27		12.40	11.02
	12.10 <i>p.m.</i>	11.28		1.00	11.02
	12.30	11.28		1.20	11.01
	12.50	11.28		1.40	11.01
	1.10	11.28		2.00	11.01
	1.30	11.28		2.20	11.01
	1.50	11.28		2.40	11.01
	2.10	11.28		3.00	11.01
	2.30	11.28		3.20	11.00
	2.50	11.28		3.40	11.00
	3.10	11.28		4.00	10.99
	3.30	11.27			
	3.50	11.26			
	4.10	11.26			
	4.30	11.27			
	4.50	11.27			

## EXTRA OBSERVATIONS—Continued.

November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station 21.—Con.</b>			<b>Station 21.—Con.</b>		
November 10, . .	4.20 <i>p.m.</i>	10.99	November 11, . .	11.20 <i>a.m.</i>	10.97
	4.40	10.99		11.50	10.99
	5.00	10.99		12.10 <i>p.m.</i>	11.00
	5.20	10.99		12.30	11.00
	5.40	10.99		12.50	11.00
	6.00	10.99		1.10	11.01
	6.20	10.98		1.30	11.01
	6.40	10.98		1.50	11.01
	7.00	10.98		2.10	11.01
	7.20	10.97		2.30	11.02
	7.40	10.97		2.50	11.02
	8.00	10.97		3.10	11.04
	8.20	10.97		3.30	11.04
	8.40	10.97		3.50	11.05
	9.00	10.96		4.10	11.06
	9.20	10.96		4.30	11.07
	9.40	10.95		4.50	11.09
	10.00	10.95	<b>Station No. 22.</b>		
	10.40	10.95	November 9, . . .	9.40 <i>a.m.</i>	11.06
	11.00	10.94		10.00	11.06
	11.20	10.94		10.10	11.06
	11.40	10.94		10.40	11.07
	12.00	10.94		11.00	11.07
November 11, . .	12.20 <i>a.m.</i>	10.94		11.20	11.07
	12.40	10.93		11.40	11.08
	1.00	10.93		12.00	11.08
	1.20	10.93		12.20 <i>p.m.</i>	11.09
	1.40	10.92		12.40	11.09
	2.00	10.92		1.00	11.09
	2.20	10.92		1.20	11.09
	2.40	10.91		1.40	11.09
	3.00	10.91		2.00	11.09
	3.20	10.91		2.20	11.09
	3.40	10.91		2.40	11.09
	4.00	10.91		3.00	11.09
	4.20	10.91		3.20	11.09
	4.40	10.90		3.40	11.08
	5.00	10.90		4.00	11.08
	6.10	10.90		4.20	11.08
	6.37	10.90		4.40	11.09
	7.10	10.89		5.00	11.09
	7.30	10.89		5.40	11.08
	8.20	10.89		6.00	11.08
	9.00	10.91		6.20	11.08
	9.40	10.93		6.40	11.09
	10.20	10.95		7.00	11.09
	10.40	10.96		7.20	11.09
	11.00	10.96		7.40	11.08

EXTRA OBSERVATIONS—Continued.  
November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
Station 22.—Con.			Station 22.—Con.		
November 9, . .	8.00 <i>p.m.</i>	11.08	November 10, .	6.50 <i>p.m.</i>	10.75
	8.20	11.08		7.10	10.75
	8.40	11.07		7.30	10.74
	9.00	11.07		7.50	10.74
	9.20	11.06		8.10	10.73
	9.40	11.06		8.30	10.72
	10.00	11.05		8.50	10.72
November 10, .	5.10 <i>a.m.</i>	10.89		9.10	10.72
	5.30	10.89		9.30	10.71
	5.50	10.89		9.50	10.71
	6.10	10.89		10.10	10.71
	6.30	10.88		10.30	10.70
	6.50	10.88		10.50	10.69
	7.10	10.88		11.10	10.69
	7.30	10.88		11.30	10.69
	7.50	10.87		11.50	10.68
	8.10	10.87	November 11, .	12.10 <i>a.m.</i>	10.68
	8.30	10.86		12.30	10.68
	8.50	10.86		12.50	10.68
	9.10	10.86		1.10	10.68
	9.30	10.86		1.30	10.67
	9.50	10.85		1.50	10.67
	10.10	10.85		2.10	10.66
	10.30	10.85		2.30	10.66
	10.50	10.84		2.50	10.66
	11.10	10.84		3.10	10.66
	11.30	10.83		3.20	10.66
	11.50	10.83		3.50	10.65
	12.10 <i>p.m.</i>	10.82		4.10	10.65
	12.30	10.81		4.30	10.65
	12.50	10.80		4.50	10.65
	1.10	10.80		6.20	10.64
	1.30	10.79		6.53	10.64
	1.50	10.79		7.20	10.64
	2.10	10.79		8.00	10.64
	2.30	10.79		8.40	10.65
	2.50	10.79		9.20	10.66
	3.10	10.78		10.00	10.68
	3.30	10.77		10.40	10.68
	3.50	10.77		10.50	10.68
	4.10	10.76		11.10	10.69
	4.30	10.76		11.40	10.71
	4.50	10.76		12.00	10.72
	5.10	10.76		12.20 <i>p.m.</i>	10.72
	5.20	10.76		12.40	10.73
	5.50	10.76		1.00	10.72
	6.10	10.75		1.20	10.72
	6.30	10.75		1.40	10.72



## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 22.—Con.</b>			<b>Station 28.—Con.</b>		
November 11, .	2.00 <i>p.m.</i>	10.72	November 9, .	8.15 <i>p.m.</i>	10.592
	2.20	10.73		8.20	10.593
	2.40	10.74		8.25	10.59
	3.00	10.74		8.30	10.588
	3.20	10.75		8.35	10.582
	3.40	10.76		8.40	10.58
	4.00	10.77		8.45	10.58
	4.20	10.78		8.50	10.578
	4.40	10.79		8.55	10.578
	5.00	10.81		9.00	10.572
<b>Station No. 28.</b>				9.05	10.577
November 9, .	5.10	10.778		9.10	10.577
	5.15	10.78		9.15	10.58
	5.20	10.782		9.20	10.58
	5.25	10.782		9.25	10.58
	5.30	10.78		9.30	10.58
	5.35	10.772		9.35	10.577
	5.40	10.765		9.40	10.577
	5.45	10.765		9.45	10.577
	5.50	10.76		9.50	10.575
	5.55	10.748		9.55	10.57
	6.00	10.743		10.00	10.57
	6.05	10.735		11.20	10.569
	6.10	10.725		11.30	10.565
	6.15	10.71		11.35	10.561
	6.20	10.70		11.40	10.56
	6.25	10.692		11.45	10.559
	6.30	10.683		11.50	10.555
	6.35	10.68		11.55	10.555
	6.40	10.67		12.00	10.551
	6.45	10.66	November 10, .	12.05 <i>a.m.</i>	10.55
	6.50	10.652		12.10	10.55
	6.55	10.647		12.15	10.545
	7.00	10.64		12.20	10.541
	7.05	10.64		12.25	10.54
	7.10	10.637		12.30	10.539
	7.15	10.63		12.35	10.539
	7.20	10.627		12.40	10.532
	7.25	10.625		12.45	10.529
	7.30	10.622		12.50	10.525
	7.35	10.622		12.55	10.525
	7.40	10.62		1.00	10.52
	7.45	10.62		1.05	10.519
	7.50	10.62		1.10	10.515
	7.55	10.61		1.15	10.515
	8.00	10.605		1.20	10.515
	8.05	10.603		1.25	10.509
	8.10	10.60		1.30	10.515

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 28.—Con.</b>			<b>Station 28.—Con.</b>		
November 10, .	1.55 <i>a.m.</i>	10.519	November 10, .	5.55 <i>a.m.</i>	10.459
	2.00	10.519		6.00	10.455
	2.05	10.519		6.05	10.455
	2.10	10.515		6.10	10.455
	2.15	10.515		6.15	10.451
	2.20	10.512		6.20	10.451
	2.25	10.51		6.25	10.455
	2.30	10.51		6.30	10.46
	2.35	10.51		6.35	10.46
	2.40	10.505		6.40	10.46
	2.45	10.502		6.45	10.459
	2.50	10.501		6.50	10.459
	2.55	10.501		6.55	10.455
	3.00	10.499		7.00	10.459
	3.05	10.492		7.05	10.459
	3.10	10.49		7.10	10.459
	3.15	10.49		7.15	10.459
	3.20	10.489		7.20	10.455
	3.25	10.489		7.25	10.455
	3.30	10.49		7.30	10.451
	3.35	10.489		7.35	10.45
	3.40	10.49		7.40	10.449
	3.45	10.485		7.45	10.445
	3.50	10.489		7.50	10.441
	3.55	10.489		7.55	10.441
	4.00	10.489		8.00	10.441
	4.05	10.489		8.05	10.44
	4.10	10.481		8.10	10.44
	4.15	10.479		8.15	10.439
	4.20	10.479		8.20	10.435
	4.25	10.475		8.25	10.435
	4.30	10.475		8.30	10.435
	4.35	10.479		8.35	10.431
	4.40	10.479		8.40	10.429
	4.45	10.475		8.45	10.425
	4.50	10.475		8.50	10.42
	4.55	10.475		8.55	10.42
	5.00	10.472		9.00	10.419
	5.05	10.471		9.05	10.411
	5.10	10.47		9.10	10.411
	5.15	10.47		9.50	10.40
	5.20	10.47		9.55	10.40
	5.25	10.469		10.00	10.397
	5.30	10.465		10.10	10.392
	5.35	10.465		10.15	10.39
	5.40	10.461		10.20	10.39
	5.45	10.461		10.25	10.39
	5.50	10.459		10.30	10.387

EXTRA OBSERVATIONS—Continued.

November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
Station 28.—Con. November 10, .	10.35 a.m.	10.385	Station 28.—Con. November 10, .	2.35 p.m.	10.367
	10.40	10.387		2.40	10.365
	10.45	10.387		2.45	10.365
	10.50	10.385		2.55	10.362
	10.55	10.39		3.00	10.362
	11.00	10.39		3.25	10.36
	11.06	10.393		3.30	10.36
	11.10	10.392		3.35	10.357
	11.15	10.39		3.40	10.357
	11.20	10.39		3.45	10.357
	11.25	10.39		4.05	10.355
	11.30	10.39		4.10	10.355
	11.35	10.39		4.15	10.355
	11.40	10.39		4.20	10.357
	11.45	10.39		4.25	10.357
	11.50	10.39		4.30	10.355
	11.55	10.387		4.35	10.355
	12.00	10.39		4.40	10.355
	12.05 p.m.	10.39		4.45	10.355
	12.10	10.39		4.50	10.355
	12.15	10.387		4.55	10.355
	12.20	10.383		5.00	10.355
	12.25	10.383		5.05	10.355
	12.30	10.383		5.10	10.353
	12.35	10.385		5.15	10.352
	12.40	10.383		5.20	10.35
	12.45	10.383		5.25	10.35
	12.50	10.383		5.30	10.35
	12.55	10.383		5.35	10.347
	1.00	10.383		5.40	10.347
	1.05	10.382		5.45	10.345
	1.10	10.382		5.50	10.345
	1.15	10.38		5.55	10.345
	1.20	10.38		6.00	10.343
	1.25	10.38		6.05	10.342
	1.30	10.38		6.10	10.342
	1.35	10.377		6.15	10.345
	1.40	10.373		6.20	10.343
	1.45	10.373		6.25	10.342
	1.50	10.372		6.30	10.34
	1.55	10.37		6.35	10.34
	2.00	10.37		6.40	10.34
	2.05	10.368		6.45	10.34
	2.10	10.368		6.50	10.338
	2.15	10.367		6.55	10.337
	2.20	10.367		7.00	10.333
	2.25	10.367		7.05	10.332
	2.30	10.367		7.10	10.33

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 28.—Con.</b> November 10, .	7.15 <i>p.m.</i>	10.33	<b>Station 28.—Con.</b> November 10, .	11.25 <i>p.m.</i>	10.295
	7.20	10.328		11.30	10.292
	7.25	10.327		11.35	10.291
	7.30	10.325		11.40	10.291
	7.35	10.325		11.45	10.29
	7.40	10.325		11.50	10.29
	7.55	10.321		11.55	10.29
	8.00	10.321		12.00	10.29
	8.05	10.321	November 11, .	12.05 <i>a.m.</i>	10.29
	8.10	10.321		12.10	10.29
	8.15	10.32		12.15	10.289
	8.20	10.32		12.20	10.289
	8.25	10.32		12.25	10.289
	8.30	10.319		12.30	10.289
	8.35	10.319		12.25	10.285
	8.40	10.319		12.40	10.285
	8.45	10.319		12.45	10.282
	8.50	10.315		12.50	10.281
	8.55	10.311		12.55	10.281
	9.00	10.311		1.00	10.281
	9.05	10.311		1.05	10.281
	9.10	10.311		1.10	10.281
	9.15	10.311		1.15	10.281
	9.20	10.31		1.20	10.281
	9.25	10.31		1.25	10.281
	9.30	10.31		1.30	10.281
	9.35	10.31		1.35	10.28
	9.40	10.31		1.40	10.28
	9.45	10.31		2.00	10.28
	9.50	10.309		2.05	10.28
	9.55	10.309		2.10	10.28
	10.00	10.305		2.15	10.279
	10.05	10.305		2.20	10.279
	10.10	10.305		2.25	10.28
	10.15	10.305		2.30	10.28
	10.20	10.305		2.35	10.28
	10.25	10.302		2.40	10.28
	10.30	10.301		2.45	10.28
	10.35	10.301		2.50	10.28
	10.40	10.201		2.55	10.279
	10.45	10.30		3.00	10.279
	10.50	10.30		3.12	10.277
	10.55	10.30		3.15	10.275
	11.00	10.30		3.20	10.273
	11.05	10.30		3.25	10.273
	11.10	10.301		3.30	10.275
	11.15	10.301		3.35	10.275
	11.20	10.301		3.40	10.275

## EXTRA OBSERVATIONS—Continued.

November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station 28.—Con.</b> November 11, .	3.45 <i>a.m.</i>	10.275	<b>Station 30.—Con.</b> November 9, . .	7.00 <i>p.m.</i>	9.60
	3.55	10.273		7.05	9.56
	4.00	10.273		7.11	9.51
	4.05	10.273		7.15	9.48
	4.10	10.273		7.20	9.45
	4.15	10.272		7.26	9.40
	4.20	10.272		7.30	9.37
	4.25	10.272		7.35	9.34
	4.30	10.275		7.40	9.31
	4.35	10.273		7.45	9.29
	4.40	10.272		7.51	9.26
	4.45	10.27		7.55	9.24
	4.50	10.27		8.00	9.21
	4.55	10.268		8.11	9.15
	5.00	10.267		8.20	9.09
	5.05	10.26		8.25	9.07
	5.10	10.26		8.35	9.02
	5.15	10.258		8.38	9.01
	5.20	10.257		8.40	9.00
	5.25	10.255		8.50	8.98
	5.30	10.253		8.57	8.98
	5.35	10.253		9.01	8.98
	5.40	10.253		9.05	9.00
	9.06	10.387		9.10	9.01
	9.35	10.393		9.23	9.05
	9.46	10.395		9.30	9.06
<b>Station No. 30.</b> November 9, . .	4.33 <i>p.m.</i>	10.335		9.35	9.06
	5.02	10.42		9.48	9.06
	5.22	10.45		10.07	9.06
	5.25	10.45		10.30	9.03
	5.30	10.43		10.45	9.01
	5.33	10.42		10.57	9.00
	5.35	10.40		11.05	8.99
	5.40	10.38		11.12	8.975
	5.45	10.36		11.15	8.97
	5.54	10.31		11.22 $\frac{1}{2}$	8.965
	6.02	10.25		11.26 $\frac{1}{2}$	8.96
	6.06	10.18		11.35	8.953
	6.11	10.12		11.38	8.96
	6.17	10.05		11.45	8.96
	6.20	10.02		11.50	8.965
	6.33	9.89		11.57	8.963
	6.39	9.82	November 10, .	12.08 <i>a.m.</i>	8.965
	6.42	9.78		12.13	8.965
	6.47	9.72		12.20	8.965
	6.50	9.70		12.33	8.975
	6.55	9.65		12.35	8.99
				12.40	8.985

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 30.—Con.</b>			<b>Station 30.—Con.</b>		
November 10, .	12.47 <i>a.m.</i>	8.98	November 10, .	6.40 <i>a.m.</i>	8.84
	12.50	8.985		6.45	8.84
	12.55	8.99		6.50	8.84
	1.17	8.99		6.55	8.843
	1.20	8.988		7.00	8.843
	1.25	8.99		7.05	8.843
	1.55	9.00		7.10	8.843
	2.00	8.995		7.15	8.843
	2.05	8.985		7.20	8.843
	2.15	8.94		7.25	8.845
	2.20	8.92		7.30	8.845
	2.25	8.905		7.35	8.845
	2.30	8.89		7.40	8.845
	2.36½	8.86		7.45	8.84
	2.40	8.85		7.50	8.84
	2.45	8.84		7.55	8.84
	2.50	8.845		8.00	8.837
	2.55	8.84		8.05	8.833
	3.00	8.84		8.10	8.832
	3.05	8.835		8.15	8.832
	3.10	8.83		8.20	8.83
	3.20	8.83		8.25	8.83
	3.25	8.83		8.30	8.83
	3.31	8.83		8.35	8.83
	3.35	8.83		8.40	8.83
	3.41	8.835		8.45	8.83
	3.45	8.835		8.50	8.83
	3.51	8.84		8.56	8.83
	3.55	8.84		9.00	8.83
	4.01	8.84		9.08	8.835
	5.13	8.82		9.10	8.84
	5.15	8.82		9.15	8.84
	5.21	8.817		9.20	8.85
	5.25	8.822		9.25	8.85
	5.30	8.82		9.30	8.85
	5.35	8.82		9.35	8.85
	5.40	8.82		9.42	8.845
	5.45	8.825		9.45	8.85
	5.50	8.83		9.52	8.84
	5.55	8.832		9.55	8.84
	6.00	8.833		10.00	8.835
	6.05	8.835		10.06	8.83
	6.10	8.85		10.10	8.83
	6.15	8.837		10.16	8.84
	6.20	8.84		10.22	8.87
	6.25	8.84		10.25	8.89
	6.30	8.84		10.30	8.92
	6.35	8.84		10.32½	8.925

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 30.—Con.</b>			<b>Station 30.—Con.</b>		
November 10, .	10.33 $\frac{1}{2}$ a.m.	8.92	November 10, .	3.47 p.m.	8.64
	10.35	8.925		3.51	8.65
	10.38	8.923		3.55	8.66
	10.40	8.92		4.01	8.665
	10.41	8.92		4.06	8.67
	10.42 $\frac{1}{2}$	8.925		4.10	8.68
	10.45	8.93		4.15	8.69
	10.47 $\frac{1}{2}$	8.94		4.20	8.70
	10.50	8.958		4.25	8.705
	10.52 $\frac{1}{2}$	8.97		4.30	8.71
	10.55	8.97		4.35	8.72
	10.58	8.97		4.40	8.73
	11.00	8.97		4.45	8.735
	11.05	8.963		4.50	8.74
	11.08	8.96		5.01	8.75
	11.10	8.95		5.07	8.75
	11.12 $\frac{1}{2}$	8.95		5.11	8.75
	11.19	8.92		5.20	8.75
	11.20	8.92		5.26	8.75
	11.22 $\frac{1}{2}$	8.905		5.30	8.75
	11.26	8.89		5.35	8.75
	11.30	8.87		5.40	8.75
	11.35	8.85		5.46	8.75
	11.40	8.83		5.50	8.745
	11.45	8.81		5.56	8.745
	11.51	8.79		6.00	8.75
	11.55	8.778		6.05	8.742
	12.00	8.76		6.10	8.74
	12.05 p.m.	8.75		6.15	8.742
	12.10	8.73		6.20	—
	12.16	8.715		6.22	8.74
	12.20	8.703		6.25	8.74
	12.25	8.69		6.30	8.75
	12.30	8.68		6.35	8.75
	12.35	8.67		6.40	8.755
	12.40	8.66		6.45	8.77
	12.45	8.66		6.55	8.78
	12.50	8.66		7.00	8.79
	1.00	8.658		7.17	8.81
	1.56	8.65		7.20	8.81
	2.01	8.645		7.25	8.811
	2.05	8.65		7.30	8.815
	2.10	8.64		7.33	8.81
	2.20	8.64		7.35	8.812
	2.30	8.635		7.40	8.80
	3.30	8.622		7.46	8.795
	3.35	8.62		7.51	8.795
	3.43	8.63		7.55	8.791

## EXTRA OBSERVATIONS—Continued.

*November 8th, 9th, 10th and 11th, 1861.*

	Hour.	Height.		Hour.	Height.
<b>Station 30.—Con.</b> November 10, .	8.00 <i>p.m.</i>	8.800	<b>Station 30.—Con.</b> November 11, .	12.40 <i>a.m.</i>	8.99
	8.12	8.803		12.46	8.99
	8.16	8.81		12.50	8.99
	8.20	8.809		12.55	8.99
	8.30	8.81		1.00	9.00
	8.40	8.81		1.10	9.003
	8.45	8.812		1.15	9.004
	8.50	8.828		1.20	9.001
	9.06	8.852		1.25	9.007
	9.10	8.862		1.30	9.018
	9.15	8.867		1.35	9.027
	9.21	8.882		1.40	9.032
	9.30	8.887		1.50	9.05
	9.35	8.89		1.58	9.042
	9.40	8.895		2.00	9.036
	9.45	8.899		2.06	9.03
	9.50	8.901		2.10	9.04
	9.55	8.907		2.15	9.043
	10.00	8.91		2.20	9.047
	10.08	8.913		2.25	9.049
	10.10	8.916		2.30	9.05
	10.15	8.912		2.35	9.06
	10.20	8.911		2.40	9.07
	10.25	8.91		2.45	9.081
	10.30	8.91		2.50	9.099
	10.35	8.908		2.55	9.11
	10.40	8.905		3.00	9.111
	10.45	8.90		3.05	9.12
	10.50	8.899		3.10	9.13
	10.55	8.90		3.15	9.135
	11.00	8.90		3.20	9.145
	11.05	8.90		3.25	9.15
	11.10	8.90		3.30	9.157
	11.15	8.899		3.35	9.161
	11.22	8.90		3.40	9.165
	11.30	8.897		3.45	9.17
	11.40	8.90		3.50	9.175
	11.45	8.901		3.55	9.175
	11.50	8.906		4.00	9.18
	11.55	8.918		4.05	9.181
	12.00	8.93		4.10	9.185
November 11, .	12.10 <i>a.m.</i>	8.95		4.15	9.199
	12.15	8.962		4.20	9.22
	12.20	8.981		4.25	9.209
	12.25	8.996		4.30	9.18
	12.26 $\frac{1}{2}$	9.00		4.35	9.15
	12.30	9.009		4.40	9.09
	12.35	9.00		4.45	9.025



EXTRA OBSERVATIONS—Continued.  
November 8th, 9th, 10th and 11th, 1861.

	Hour.	Height.		Hour.	Height.
<b>Station 30.—Con.</b>			<b>Station 31.—Con.</b>		
November 11, .	4.50 a.m.	8.971	November 9, .	3.17 p.m.	12.64
	4.55	8.905	November 10, .	9.51 a.m.	12.19
	5.00	8.852		11.40	12.17
	5.05	8.801		4.55 p.m.	12.21
	5.10	8.74	November 11, .	6.30 a.m.	12.29
	5.15	8.739		7.32	12.49
	5.20	8.745		10.18	12.88
	5.25	8.79		2.15 p.m.	12.77
	5.30	8.861	<b>Station No. 32.</b>		
	5.35	8.98	November 8, .	8.32	13.00
	5.40	9.071	November 9, .	7.12 a.m.	13.13
	5.54	9.17		10.25	13.18
	5.50	9.261		11.34	13.18
	5.55	9.35		3.12 p.m.	13.12
	6.00	9.42	November 10, .	9.46 a.m.	12.67
	6.05	9.50		11.44	12.66
	6.10	9.53		4.50 p.m.	12.62
	6.15	9.57	November 11, .	6.34 a.m.	12.61
	6.20	9.59		7.27	13.12
	6.25	9.625		10.13	13.23
	6.30	9.651		2.20 p.m.	13.25
	6.35	9.687	<b>Station No. 33.</b>		
	6.40	9.715	November 8, .	9.18	17.28
	6.45	9.751	November 9, .	6.38 a.m.	16.72
	6.50	9.78		9.45	17.18
	6.55	9.81		10.52	17.19
	7.00	9.83		2.36 p.m.	17.04
	7.05	9.85	November 10, .	9.18 a.m.	16.75
	8.08	10.07		12.00	16.80
	10.25	10.11		4.28 p.m.	16.84
<b>Station No. 31.</b>			November 11, .	6.48 a.m.	17.18
November 8, .	8.38 p.m.	12.76		7.08	17.35
November 9, .	7.17 a.m.	12.32		9.51	17.37
	10.30	12.78		2.36 p.m.	17.38
	11.39	12.80			

## EXTRA OBSERVATIONS—Concluded.

## GENERAL.

November 8th, 9th, 10th and 11th, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 8, .	2	7.55 <i>a.m.</i>	12.83	Nov. 10, .	16	1.05 <i>p.m.</i>	11.48
	3	8.05	12.79		15	1.15	11.51
	4	8.20	12.73		14	1.25	11.55
	5	8.30	12.63		13	1.32	11.59
	6	8.38	12.61		12	2.17	11.63
	7	8.55	12.35		11	2.45	11.71
	10	9.35	12.05		10	3.00	11.88
	11	9.42	11.90		7	3.45	12.15
	12	9.55	11.83		6	4.08	12.44
	13	10.47	11.78		5	4.18	12.45
Nov. 9, .	14	10.55	11.75	Nov. 11, .	4	4.30	12.54
	15	11.08	11.75		3	4.40	12.58
	16	11.22	11.71		2	4.50	12.62
	17	11.25	11.65		2	7.35 <i>a.m.</i>	12.51
	18	11.30	11.66		3	7.45	12.47
	19	11.35	11.44		4	7.55	12.42
	20	11.40	11.40		5	8.05	12.32
	21	1.50 <i>p.m.</i>	11.28		6	9.15	12.31
	22	1.55	11.09		7	8.30	12.00
	23	2.10	10.93		10	9.05	11.72
Nov. 10, .	24	2.30	10.90		11	9.20	11.56
	25	2.40	10.88		12	9.40	11.48
	26	3.08	10.87		13	10.20	11.46
	27	4.15	10.87		14	10.30	11.43
	28	4.30	10.76		15	10.40	11.43
	29	4.37	10.35		16	10.48	11.40
	30	4.40	10.35		17	10.57	11.34
	30	7.55 <i>a.m.</i>	8.84		18	11.00	11.36
	29	8.02	8.88		19	11.08	11.08
	28	8.15	10.44		20	11.15	11.01
Nov. 10, .	27	8.35	10.60		21	12.30 <i>p.m.</i>	11.00
	26	9.45	10.63		22	12.35	10.73
	25	10.12	10.65		23	1.50	10.51
	24	10.25	10.64		24	2.05	10.50
	23	10.48	10.69		25	2.20	10.51
	22	11.05	10.84		26	2.50	10.53
	21	11.15	11.05		27	4.00	10.62
	20	12.37 <i>p.m.</i>	11.07		28	4.15	10.53
	19	12.45	11.12		29	4.25	10.22
	18	12.50	11.35		30	4.30	10.23
	17	12.55	11.35		30	9.00	10.43

## GENERAL OBSERVATIONS.

October, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Oct. 14, .	7	3.15 <i>p.m.</i>	11.40	Oct. 16, .	5	2.15 <i>p.m.</i>	11.73
	5	3.45	11.74		4	2.25	11.82
	4	4.00	11.83		3	2.40	11.85
	3	4.10	11.86		2	2.50	11.92
	2	4.20	11.93	Oct. 17, .	2	4.00	11.98
	1	5.10	12.22	Oct. 18, .	2	8.00 <i>a.m.</i>	11.96
Oct. 15, .	2	8.00 <i>a.m.</i>	11.91		2	9.30	11.95
	3	8.15	11.85		2	11.00	11.94
	4	8.25	11.82		2	2.00 <i>p.m.</i>	11.96
	5	8.35	11.74		2	5.30	12.01
	7	9.00	11.38	Oct. 19, .	2	8.15 <i>a.m.</i>	11.99
	10	9.40	11.06		3	8.20	11.94
	11	11.10	10.95		4	8.35	11.90
	15	12.20 <i>p.m.</i>	10.91		5	8.40	11.82
	16	12.30	10.90		7	9.10	11.47
	17	12.40	10.87		10	9.45	11.14
	19	2.00	10.63		11	9.50	11.03
	20	2.10	10.59		15	11.05	10.93
	21	2.20	10.58		16	11.15	10.91
	22	2.30	10.26		17	11.20	10.88
	23	2.45	10.17		18	11.25	10.91
	24	2.55	10.11	Oct 20, .	17	9.00	10.83
	25	3.10	10.10		18	9.05	10.83
	26	3.40	10.09		19	9.10	10.65
	27	4.50	10.13		20	9.15	10.62
	28	5.05	10.06		21	9.30	10.63
	29	5.15	9.83		22	9.35	10.43
	30	5.20	9.82		23	9.50	10.35
	30	9.00	10.08		24	10.00	10.34
Oct. 16, .	30	6.00 <i>a.m.</i>	10.13		25	10.10	10.34
	30	7.00	10.01		26	10.40	10.32
	29	7.05	10.00		27	11.55	10.40
	28	7.15	10.15		28	12.20 <i>p.m.</i>	10.34
	27	7.30	10.21		29	12.30	10.24
	26	8.35	10.13		30	12.35	10.24
	25	9.10	10.14		29	12.50	10.23
	24	9.20	10.15		28	1.00	10.34
	23	9.35	10.17		27	1.15	10.40
	22	9.50	10.25		26	2.35	10.33
	21	9.55	10.48		25	3.10	10.35
	20	10.10	10.50		24	3.25	10.36
	19	10.15	10.54		23	3.40	10.39
	18	11.00	10.84		22	4.00	10.48
	17	11.05	10.81		21	4.10	10.70
	16	11.10	10.85		20	4.25	10.71
	15	11.20	10.88		19	4.30	10.75
	11	12.30 <i>p.m.</i>	10.97		18	4.35	10.98
	10	12.55	11.06		17	4.40	10.97
	7	1.50	11.37	Oct. 21, .	17	9.20 <i>a.m.</i>	10.98

## GENERAL OBSERVATIONS—Continued.

October, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Oct. 21, .	16	9.30 <i>a.m.</i>	11.00	Oct. 24, .	21	11.55 <i>a.m.</i>	10.88
	15	9.40	11.04		20	1.30 <i>p.m.</i>	10.88
	11	11.45	11.14		20	6.30	10.89
	10	11.55	11.23	Oct. 25, .	20	8.05 <i>a.m.</i>	10.80
	7	12.35 <i>p.m.</i>	11.51		19	8.15	10.84
	5	1.05	11.89		18	8.24	11.07
	4	1.15	12.02		17	8.30	11.06
	3	1.30	12.16		16	8.40	11.12
	2	1.40	12.15		15	8.45	11.15
Oct. 22, .	2	8.30 <i>a.m.</i>	12.07		14	9.11	11.06
	3	8.40	12.03		13	9.25	11.17
	4	8.50	11.99		12	10.38	11.20
	5	9.00	11.91		11	11.00	11.26
	7	9.20	11.58		10	11.13	11.39
	10	9.50	11.29		7	12.05 <i>p.m.</i>	11.68
	11	10.00	11.18		6	1.00	12.01
	15	11.10	11.12		5	1.27	12.02
	16	11.15	11.09		4	1.45	12.11
	17	11.25	11.08		3	2.00	12.15
	18	11.30	11.12		2	2.12	12.19
Oct. 23, .	17	9.00	11.03	Oct. 26, .	2	8.00 <i>a.m.</i>	12.20
	18	9.03	11.06		3	8.10	12.14
	19	9.07	10.83		4	8.25	12.10
	20	9.11	10.78		5	8.40	11.99
	17	1.20 <i>p.m.</i>	11.14		6	8.53	11.99
	18	1.25	11.17		7	9.18	11.65
	19	1.30	10.91		10	10.15	11.36
	20	1.35	10.85		11	10.25	11.24
	21	1.45	10.85		12	10.40	11.19
	22	1.50	10.58		13	11.25	11.20
	23	2.00	10.45		14	11.35	11.18
	24	2.10	10.41		15	11.45	11.19
	25	2.25	10.39		16	11.55	11.18
	26	2.55	10.39		17	12.00	10.97
	27	4.25	10.50		18	12.05 <i>p.m.</i>	11.18
	28	4.40	10.42		19	12.15	10.92
	29	4.45	10.17		20	12.25	10.86
	30	4.50	10.17		21	1.40	10.84
	30	9.00	10.34		22	1.45	10.59
Oct. 24, .	30	6.00 <i>a.m.</i>	10.35		23	2.15	10.46
	30	7.30	10.20		24	2.30	10.43
	29	7.40	10.17		25	2.46	10.43
	28	7.53	10.42		26	3.15	10.41
	27	8.20	10.50		27	4.20	10.49
	26	9.40	10.41		28	5.00	10.44
	25	10.20	10.43		29	5.10	10.29
	24	10.41	10.44		30	5.20	10.30
	23	11.03	10.48		30	9.00	10.34
	22	11.30	10.61	Oct. 27, .	30	6.15 <i>a.m.</i>	10.35

## GENERAL OBSERVATIONS—Continued.

October, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Oct. 27, .	30	7.54 <i>a.m.</i>	10.35	Oct. 28, .	26	4.05 <i>p.m.</i>	10.43
	29	7.58	10.35		27	5.25	10.47
	28	8.05	10.49		28	5.45	10.41
	27	8.25	10.54		29	5.55	10.23
	26	9.35	10.47		30	6.06	10.24
	25	10.10	10.50	Oct. 29, .	30	9.00	10.31
	24	10.20	10.52		30	6.00 <i>a.m.</i>	10.29
	23	10.35	10.52		30	7.00	10.23
	22	11.10	10.63		29	7.05	10.22
	21	11.20	10.79		28	7.15	10.39
	20	1.12 <i>p.m.</i>	10.82		27	7.30	10.46
	19	1.20	10.83		26	8.45	10.42
	18	1.25	11.02		25	9.20	10.45
	17	1.30	11.02		24	9.35	10.47
	16	1.43	11.08		23	9.40	10.49
	15	1.53	11.12		22	10.20	10.59
	14	2.05	11.13		21	10.30	10.78
	13	2.15	11.14		20	12.20 <i>p.m.</i>	10.81
	12	3.00	11.19		19	12.30	10.85
	11	3.15	11.25		18	12.42	11.09
	10	3.25	11.36		17	12.45	11.06
	7	4.00	11.62		16	12.50	11.08
	6	4.25	11.87		15	1.00	11.08
	5	4.35	11.88		14	1.12	11.09
	4	4.50	11.96		13	1.15	11.07
	3	5.04	12.00		12	2.05	11.17
	2	5.13	12.04		11	2.18	11.23
Oct. 28, .	2	8.00 <i>a.m.</i>	11.85		10	2.25	11.31
	3	8.10	11.82		7	3.02	11.55
	4	8.25	11.77		6	3.25	11.82
	5	8.35	11.70		5	3.40	11.84
	6	8.50	11.68		4	3.50	11.98
	7	9.12	11.46		3	4.03	12.03
	10	9.55	11.26		2	4.18	12.09
	11	10.05	11.18	Oct. 30, .	2	8.10 <i>a.m.</i>	12.13
	12	10.30	11.12		3	8.20	12.07
	13	11.40	11.08		4	8.30	12.02
	14	11.50	11.08		5	8.45	11.91
	15	12.08 <i>p.m.</i>	11.10		6	8.55	11.89
	16	12.17	11.07		7	9.15	11.57
	17	12.30	11.06		10	9.50	11.18
	18	12.35	11.11		11	10.00	11.14
	19	12.40	10.87		12	10.15	11.10
	20	1.00	10.83		13	11.00	11.09
	21	2.15	10.82		14	11.15	11.09
	22	2.25	10.61		15	11.25	11.11
	23	2.40	10.50		16	11.35	11.10
	24	2.55	10.48		17	11.45	11.06
	25	3.20	10.45		18	11.50	11.11

## GENERAL OBSERVATIONS—Continued.

*October and November, 1861.*

	Station.	Hour.	Height.		Station.	Hour.	Height.
Oct. 30, .	19	11.55 <i>a.m.</i>	10.85	Nov. 1, .	12	10.23 <i>a.m.</i>	11.01
	20	12.00	10.80		13	11.18	10.99
	21	2.20 <i>p.m.</i>	10.80		14	11.28	10.98
	22	2.26	10.57		15	11.40	10.99
	23	2.40	10.46		16	11.50	10.98
	24	2.53	10.44		17	12.00	10.96
	25	3.04	10.42		18	12.05 <i>p.m.</i>	10.99
	26	3.30	10.40		19	12.13	10.76
	27	4.40	10.47		20	12.20	10.72
	28	4.54	10.41		21	1.15	10.72
	29	5.03	10.24		22	1.22	10.52
	30	5.08	10.24		23	1.38	10.40
	30	9.00	10.33		24	1.53	10.39
Oct. 31, .	30	6.05 <i>a.m.</i>	10.31		25	2.07	10.37
	30	7.05	10.26		26	2.45	10.41
	29	7.10	10.25		27	4.05	10.42
	28	7.20	10.42		28	4.20	10.37
	27	7.35	10.47		29	4.30	10.21
	26	9.03	10.38		30	4.38	10.21
	25	9.30	10.38	Nov. 2, .	30	8.10 <i>a.m.</i>	10.19
	24	9.48	10.40		29	8.18	10.19
	23	10.12	10.41		28	8.30	10.34
	22	10.35	10.52		27	8.45	10.40
	21	10.45	10.73		26	10.00	10.33
	20	12.12 <i>p.m.</i>	10.78		25	10.35	10.36
	19	12.20	10.83		24	10.55	10.38
	18	12.27	11.09		23	11.12	10.39
	17	12.30	11.04		22	11.30	10.49
	16	12.38	11.06		21	11.35	10.69
	15	12.48	11.08		20	1.55 <i>p.m.</i>	10.74
	14	1.00	11.07		19	2.05	10.77
	13	1.10	11.06		18	2.10	10.99
	12	2.02	11.09		17	2.15	10.96
	11	2.25	11.13		16	2.25	10.99
	10	2.40	11.14		15	2.32	11.02
	7	3.45	11.47		14	2.50	11.00
	6	4.10	11.72		13	3.05	10.69
	5	5.10	11.73		12	4.00	11.07
	4	5.20	11.85		11	4.20	11.12
	3	5.45	11.88		10	4.30	11.23
	2	6.00	11.92		7	5.20	11.44
Nov. 1, .	2	8.05 <i>a.m.</i>	11.96		6	5.45	11.69
	3	8.20	11.90		5	6.00	11.74
	4	8.35	11.85		4	6.15	11.84
	5	8.47	11.75		3	6.50	11.88
	6	8.55	11.73		2	7.05	11.93
	7	9.12	11.49	Nov. 3, .	2	9.20 <i>a.m.</i>	12.18
	10	9.50	11.20	Nov. 4, .	2	7.50	12.29
	11	10.05	11.06		3	8.00	12.27

## GENERAL OBSERVATIONS—Continued.

November, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 4, .	4	8.15 <i>a.m.</i>	12.23	Nov. 5, .	4	5.00 <i>p.m.</i>	12.73
	5	8.30	12.15		3	5.15	12.79
	6	8.40	12.16		2	5.25	12.85
	7	9.00	11.94	Nov. 6, .	2	7.55 <i>a.m.</i>	12.89
	10	9.45	11.75		3	8.03	12.84
	11	9.55	11.65		4	8.15	12.78
	12	10.10	11.61		5	8.25	12.67
	13	10.55	11.62		6	8.35	12.66
	14	11.05	11.61		7	8.50	12.42
	15	11.15	11.65		10	9.35	12.21
	16	11.25	11.62		11	9.50	12.10
	17	11.35	11.62		12	10.12	12.04
	18	11.40	11.69		13	11.05	12.02
	19	11.45	11.36		14	11.20	12.01
	20	11.55	11.28		15	11.30	12.01
	21	1.30 <i>p.m.</i>	11.29		16	11.37	11.98
	22	1.40	11.01		17	11.45	11.95
	23	1.52	10.78		18	11.50	11.97
	24	2.05	10.74		19	11.55	11.73
	25	2.17	10.73		20	12.00	11.67
	26	2.45	10.73		21	1.55 <i>p.m.</i>	11.61
	27	3.55	10.78		22	2.05	11.43
	28	4.20	10.67		23	2.20	11.22
	29	4.30	10.24		24	2.35	11.19
	30	4.35	10.24		25	2.50	11.18
Nov. 5, .	30	7.15 <i>a.m.</i>	10.42		26	3.20	11.16
	29	7.22	10.42		27	4.35	11.12
	28	7.35	10.94		28	4.50	10.99
	27	7.55	11.07		29	5.00	10.51
	26	9.10	11.07	Nov. 7, .	29	7.55 <i>a.m.</i>	10.49
	25	9.50	11.08		28	8.10	10.98
	24	10.12	11.11		27	8.25	11.12
	23	10.30	11.15		26	10.25	11.23
	22	10.55	11.37		25	11.05	11.16
	21	11.00	11.60		24	11.20	11.15
	20	1.00 <i>p.m.</i>	11.68		23	11.50	11.20
	19	1.08	11.75		22	12.10 <i>p.m.</i>	11.46
	18	1.15	12.04		21	12.20	11.52
	17	1.20	12.00		20	1.20	11.56
	16	1.30	12.01		19	1.30	11.61
	15	1.37	12.04		18	1.35	11.80
	14	1.50	12.02		17	1.40	11.81
	13	2.00	12.02		16	1.50	11.85
	12	2.45	12.04		15	2.00	11.88
	11	3.20	12.10		14	2.12	11.89
	10	3.30	12.17		13	2.25	11.90
	7	4.15	12.34		12	3.15	11.99
	6	4.40	12.57		11	3.35	12.07
	5	4.50	12.59		10	3.50	12.16

## GENERAL OBSERVATIONS—Continued.

November, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 7, .	7	4.35 <i>p.m.</i>	12.41	Nov. 10, .	14	1.25 <i>p.m.</i>	11.55
	6	4.55	12.63		13	1.32	11.59
	5	5.05	12.64		12	2.17	11.63
	4	5.15	12.76		11	2.45	11.71
	3	5.30	12.82		10	3.00	11.88
	2	5.40	12.87		7	3.45	12.15
Nov. 8, .	2	7.55 <i>a.m.</i>	12.83		6	4.08	12.44
	3	8.05	12.79		5	4.18	12.45
	4	8.20	12.73		4	4.30	12.54
	5	8.30	12.63		3	4.40	12.58
	6	8.38	12.61		2	4.50	12.62
	7	8.55	12.35	Nov. 11, .	2	7.35 <i>a.m.</i>	12.51
	10	9.35	12.05		3	7.45	12.47
	11	9.42	11.90		4	7.55	12.42
	12	9.55	11.83		5	8.05	12.32
	13	10.47	11.78		6	8.15	12.31
	14	10.55	11.75		7	8.30	12.00
	15	11.08	11.75		10	9.05	11.72
	16	11.22	11.71		11	9.20	11.56
	17	11.25	11.65		12	9.40	11.48
	18	11.30	11.66		13	10.20	11.46
	19	11.35	11.44		14	10.30	11.43
	20	11.40	11.40		15	10.40	11.43
Nov. 9, .	21	1.50 <i>p.m.</i>	11.28		16	10.48	11.40
	22	1.55	11.09		17	10.57	11.34
	23	2.10	10.93		18	11.00	11.36
	24	2.30	10.90		19	11.08	11.08
	25	2.40	10.88		20	11.15	11.01
	26	3.08	10.87		21	12.30 <i>p.m.</i>	11.00
	27	4.15	10.87		22	12.35	10.73
	28	4.30	10.76		23	1.50	10.51
	29	4.37	10.35		24	2.05	10.50
	30	4.40	10.35		25	2.20	10.51
Nov. 10, .	30	7.55 <i>a.m.</i>	8.84		26	2.50	10.53
	29	8.02	8.88		27	4.00	10.62
	28	8.15	10.44		28	4.15	10.53
	27	8.35	10.60		29	4.25	10.22
	26	9.45	10.63		30	4.30	10.23
	25	10.12	10.65		30	9.00	10.43
	24	10.25	10.64	Nov. 12, .	30	6.20 <i>a.m.</i>	10.45
	23	10.48	10.69		30	7.20	10.35
	22	11.05	10.84		29	7.30	10.33
	21	11.15	11.05		28	7.40	10.69
	20	12.37 <i>p.m.</i>	11.07		27	8.00	10.80
	19	12.45	11.12		26	9.25	10.80
	18	12.50	11.35		25	9.50	10.81
	17	12.55	11.35		24	10.10	10.85
	16	1.05	11.48		23	10.30	10.87
	15	1.15	11.51		22	10.50	11.03



## GENERAL OBSERVATIONS—Continued.

November, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 12, .	21	11.00 <i>a.m.</i>	11.20	Nov. 14, .	29	4.55 <i>p.m.</i>	10.40
	20	12.27 <i>p.m.</i>	11.24		30	5.00	10.41
	19	12.33	11.29	Nov. 15, .	30	6.15 <i>a.m.</i>	10.45
	18	12.40	11.51		30	7.00	10.39
	17	12.45	11.50		29	7.05	10.37
	16	12.53	11.53		28	7.17	10.71
	15	1.03	11.58		27	7.35	10.80
	14	1.15	11.56		26	8.45	10.76
	13	1.25	11.58		25	9.12	10.76
	12	2.15	11.68		24	9.23	10.78
	11	2.35	11.76		23	9.45	10.80
	10	2.50	11.85		22	10.05	10.93
	7	3.28	12.08		21	10.10	11.10
	6	3.50	12.35		20	12.01 <i>p.m.</i>	11.15
	5	4.00	12.38		19	12.10	11.20
	4	4.13	12.51		18	12.15	11.40
	3	4.35	12.61		17	12.20	11.40
	2	4.45	12.65		16	12.28	11.42
Nov. 13, .	2	8.10 <i>a.m.</i>	12.62		15	12.37	11.46
	3	8.25	12.58	Nov. 16, .	14	12.47	11.46
	4	8.40	12.52		13	12.55	11.47
	5	9.30	12.38		12	1.50	11.53
	6	9.50	12.37		11	2.05	11.61
	7	10.30	12.09		10	2.15	11.70
	10	11.40	11.85		7	2.55	11.94
	11	12.05 <i>p.m.</i>	11.73		6	3.15	12.17
	12	12.30	11.67		5	3.27	12.18
	13	3.30	11.65		4	3.45	12.30
	14	3.45	11.63		3	4.00	12.35
	15	4.00	11.63		2	4.10	12.40
	16	4.10	11.59		2	7.55 <i>a.m.</i>	12.30
	17	4.15	11.65		3	8.05	12.25
	18	4.20	11.55		4	8.20	12.20
	19	4.30	11.34		5	8.40	12.08
	20	4.38	11.29		6	8.50	12.06
	21	5.00	11.25		7	9.10	11.82
Nov. 14, .	16	9.00 <i>a.m.</i>	11.50		10	9.55	11.57
	17	9.10	11.45	Nov. 17, .	11	10.05	11.47
	18	9.15	11.47		12	10.25	11.41
	19	9.25	11.26		13	12.05 <i>p.m.</i>	11.33
	20	9.33	11.22		14	12.20	11.33
	21	1.40 <i>p.m.</i>	11.20		15	12.35	11.34
	22	1.50	11.03		16	12.45	11.31
	23	2.10	10.90		17	12.55	11.30
	24	2.25	10.86		18	1.03	11.30
	25	2.43	10.84		19	1.10	11.11
	26	3.15	10.84		20	1.15	11.05
	27	4.30	10.86		21	12.30	10.93
	28	4.45	10.76		22	12.40	10.78

GENERAL OBSERVATIONS—Continued.  
November, 1861.

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 17, .	23	12.55 <i>p.m.</i>	10.68	Nov. 20, .	11	1.30 <i>p.m.</i>	11.28
	24	1.10	10.67		12	1.45	11.24
	25	2.25	10.65		13	4.00	11.22
	26	3.05	10.66		14	4.15	11.20
	27	4.35	10.68		15	4.25	11.21
	28	4.50	10.59		16	4.30	11.18
	29	5.00	10.38		17	4.40	11.13
	30	5.05	10.39		18	4.45	11.15
	30	9.00	10.39		19	4.50	10.93
Nov. 18, .	30	6.15 <i>a.m.</i>	10.40		20	5.00	10.89
	30	7.05	10.23	Nov. 21, .	16	10.55 <i>a.m.</i>	11.07
	29	7.10	10.21		17	11.03	11.01
	28	7.25	10.48		18	11.07	11.01
	27	7.40	10.56		19	11.15	10.84
	26	9.10	10.53		20	11.20	10.81
	25	9.50	10.53		21	2.12 <i>p.m.</i>	10.78
	24	10.05	10.56		22	2.17	10.64
	23	10.25	10.57		23	2.35	10.53
	22	10.45	10.68		24	2.45	10.52
	21	10.53	10.86		25	2.55	10.50
	20	12.53 <i>p.m.</i>	10.89		26	3.20	10.47
	19	1.00	10.92		27	4.30	10.53
	18	1.05	11.16		28	4.47	10.48
	17	1.10	11.12		29	4.55	10.29
	16	1.18	11.14		30	5.00	10.29
	15	1.27	11.16		30	9.00	10.30
	14	1.40	11.14	Nov. 22, .	30	6.30 <i>a.m.</i>	10.29
	13	1.47	11.14		30	10.25	10.11
	12	2.35	11.18		30	11.15	10.09
	11	2.50	11.22		29	11.20	10.09
	10	3.00	11.26		28	11.30	10.35
	7	3.40	11.42		27	11.45	10.43
	6	4.02	11.64		26	1.25 <i>p.m.</i>	11.40
	5	4.12	11.65		25	2.00	10.42
	4	4.30	11.84		24	2.25	10.43
	3	4.47	11.91		23	2.50	10.45
	2	5.00	11.99		22	3.30	10.56
Nov. 19, .	2	8.10 <i>a.m.</i>	12.01		21	3.40	10.75
	2	9.55	11.97		20	4.33	10.77
	2	1.20 <i>p.m.</i>	11.95		19	4.40	10.81
	2	4.10	11.99		18	4.45	11.03
Nov. 20, .	2	9.00 <i>a.m.</i>	12.10		17	4.50	11.00
	2	11.10	12.06		16	5.00	11.02
	3	11.25	12.01	Nov. 23, .	22	9.15 <i>a.m.</i>	10.50
	4	11.35	11.95		21	9.35	10.66
	5	11.50	11.83		20	10.45	10.71
	6	12.00	11.81		19	10.55	10.75
	7	12.25 <i>p.m.</i>	11.59		18	11.00	11.00
	10	1.20	11.38		17	11.05	10.95

## GENERAL OBSERVATIONS—Concluded.

*November, 1861.*

	Station.	Hour.	Height.		Station.	Hour.	Height.
Nov. 23, .	16	11.15 <i>a.m.</i>	10.96	Nov. 26, .	25	10.15 <i>a.m.</i>	10.69
	15	11.22	10.99		26	10.45	10.67
	14	11.35	10.97		27	12.05 <i>p.m.</i>	10.72
	13	11.42	10.97		28	12.20	10.62
	12	1.30 <i>p.m.</i>	11.03		29	12.30	10.37
	2	6.25	11.77		30	12.35	10.37
Nov. 24, .	2	8.00 <i>a.m.</i>	11.98		30	4.15	10.36
	12	1.45 <i>p.m.</i>	11.15		30	9.00	10.42
	13	3.45	11.13	Nov. 27, .	30	7.20 <i>a.m.</i>	10.40
	14	3.55	11.13		29	7.28	10.40
	15	4.10	11.14		28	7.45	10.71
	16	4.17	11.11		27	8.05	10.90
	17	4.25	11.07		26	9.30	10.75
	18	4.30	11.08		25	10.15	10.77
	19	4.37	10.89		24	10.30	10.79
	20	4.45	10.86		23	10.50	10.83
	21	5.45	10.84		22	11.01	10.97
	22	5.55	10.69		21	11.20	11.15
Nov. 25, .	16	8.45 <i>a.m.</i>	11.12		20	1.15 <i>p.m.</i>	11.19
	17	8.55	11.12		19	1.25	11.24
	18	9.00	11.16		18	1.30	11.46
	19	9.08	10.95		17	1.35	11.44
	20	9.15	10.91		16	1.45	11.48
	21	10.30	10.93		15	2.05	11.51
	22	10.37	10.77		14	2.28	11.49
	16	5.15 <i>p.m.</i>	11.27		13	2.35	11.51
	17	5.05	11.26		13	3.50	11.51
	18	5.00	11.30		14	4.00	11.50
	19	4.50	11.05		15	4.20	11.52
	20	4.43	11.00		16	4.28	11.48
	21	1.30	10.95		17	4.37	11.45
	22	1.40	10.77		18	4.45	11.48
Nov. 26, .	21	9.20 <i>a.m.</i>	11.04		19	4.50	11.26
	22	9.28	10.86		20	5.00	11.21
	23	9.42	10.73	Nov. 28, .	22	8.30 <i>a.m.</i>	10.97
	24	9.55	10.70		21	8.40	11.12

MEAN HEIGHTS FOR EACH DAY.—CONCORD AND SUDBURY RIVERS.

September 17th to October 14th, 1861.

Stations,	3.	4.		5.		10.		11.		17.	18.	19.	20.	21.	22.		28.	29.	30.
Sept. 17,	12.74	—	—	—	—	11.77	0.42	11.35	—	11.07	11.08	10.78	10.73	10.72	10.38	—	10.16	9.91	9.91
18,	12.77	—	—	—	—	11.76	0.43	11.33	—	11.06	11.07	10.75	10.69	10.69	10.32	—	10.05	9.80	9.77
19,	12.75	—	—	—	—	11.75	0.44	11.31	—	11.03	11.04	10.71	10.65	10.65	10.27	—	10.05	9.78	9.79
20,	12.73	—	—	—	—	11.73	0.46	11.27	—	11.00	11.01	10.68	10.63	10.61	10.23	—	9.99	9.76	9.75
21,	12.70	—	—	—	—	11.71	0.47	11.24	—	10.97	10.98	10.65	10.61	10.60	10.23	—	10.05	9.88	9.88
22,	12.64	—	—	—	—	11.76	0.48	11.28	—	10.92	10.91	10.65	10.62	10.61	10.34	—	10.19	10.11	10.11
23,	12.65	—	—	—	—	11.80	0.40	11.40	—	11.17	11.18	10.89	10.84	10.83	10.50	—	10.27	10.05	10.06
24,	12.67	—	—	—	—	11.74	0.44	11.30	—	11.01	11.02	10.74	10.69	10.69	10.38	—	10.16	9.90	9.89
25,	12.66	—	—	—	—	11.71	0.46	11.25	—	11.15	11.20	10.84	10.78	10.76	10.36	—	10.10	9.89	9.87
26,	12.62	—	—	—	—	11.82	0.32	11.50	—	11.34	11.35	11.05	11.00	10.98	10.67	—	10.42	10.20	10.21
27,	12.61	—	—	—	—	11.76	0.44	11.32	—	11.10	11.12	10.83	10.79	10.78	10.49	—	10.30	10.11	10.11
28,	12.65	—	—	—	—	11.72	0.48	11.24	—	11.04	11.06	10.76	10.71	10.64	10.37	—	10.25	10.06	10.07
29,	12.58	—	—	—	—	11.68	0.51	11.17	—	10.82	10.84	10.58	10.56	—	—	—	—	—	—
30,	—	—	—	—	—	11.59	0.50	11.09	—	—	—	—	—	—	—	—	—	—	—
Oct. 1,	—	12.47	0.20	12.27	—	—	—	—	} Weeds cut between Stations 4 and 5.										
2,	—	12.44	0.13	12.31	—	—	—	—											
3,	—	12.40	0.09	12.31	—	—	—	—											
4,	—	12.26	0.05	12.21	—	—	—	—											
5,	—	12.29	0.09	12.20	—	—	—	—											
6,	—	12.38	0.07	12.31	—	—	—	—											
7,	—	12.16	0.05	12.11	—	11.48	0.43	11.05											
8,	—	—	—	—	—	11.34	0.26	11.08	Weeds cut at "Robbins's Bar."										
9,	—	—	—	—	—	11.22	0.10	11.12											
10,	—	—	—	—	—	11.19	0.10	11.09											
11,	—	—	—	—	—	11.17	0.10	11.07											
12,	—	—	—	—	—	11.17	0.10	11.07											
13,	—	—	—	—	—	11.20	0.12	11.08											
14,	—	—	—	—	—	11.08	0.09	10.99											

# [E.]

Days selected to show that the River may be nearly the same above "Robbins's Bar," with the Dam lowered or raised.

Stations, .		3.		7.	8.	9.	10.	11.	12.		17.		30.	
July 28, .	—	12.58	—	12.04	12.04	11.88	11.87	11.67	11.64	—	11.36	—	10.28	Dam closed.
Aug. 12, .	—	12.65	—	12.05	12.05	11.84	11.82	11.50	11.47	—	11.15	—	7.25	Water 33 inches below Bolt.
Sept. 12, .	—	12.76	—	12.05	12.04	11.83	11.80	11.46	11.43	—	11.14	—	9.92	} Dam closed.
26, .	—	12.62	—	—	—	—	11.82	11.50	—	—	11.34	—	10.21	
Aug. 7, .	—	12.71	—	12.14	12.14	11.97	11.96	11.73	11.70	—	11.43	—	10.10	Dam closed.
11, .	—	12.76	—	12.09	12.09	11.88	11.85	11.54	11.51	—	11.16	—	8.64	Water 16½ inches below Bolt.
Sept. 1, .	—	12.90	—	12.15	12.14	11.88	11.84	11.44	11.41	—	10.92	—	7.23	Water 33 inches below Bolt.
14, .	—	12.87	—	12.14	12.13	11.87	11.84	11.44	11.41	—	11.20	—	9.95	} Dam closed.
16, .	—	12.72	—	12.14	12.14	11.88	11.84	11.44	11.40	—	11.18	—	10.05	
26, .	—	12.62	—	—	—	—	11.82	11.50	—	—	11.34	—	10.21	
Sept. 2, .	—	12.78	—	12.08	12.07	11.82	11.78	11.39	11.36	—	11.06	—	7.17	} Water 33 inches below Bolt.
3, .	—	12.76	—	12.03	12.02	11.78	11.75	11.36	11.33	—	11.00	—	7.27	
4, .	—	12.78	—	12.01	12.00	11.75	11.72	11.34	11.30	—	10.97	—	7.27	
17, .	—	12.74	—	—	—	—	11.77	11.35	—	—	11.07	—	9.91	} Dam closed.
18, .	—	12.77	—	—	—	—	11.76	11.33	—	—	11.06	—	9.77	
27, .	—	12.61	—	—	—	—	11.76	11.32	—	—	11.10	—	10.11	

1862.]

HOUSE—No. 1.

109

## [ F . ]

*Table showing the Mean Heights of the Principal Meadows above a base line which is ten feet below the Bolt at North Billerica.*

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Beaver Hole Meadows about Station 1, . . . . .	13.68
Meadows near Heard's Pond, . . . . .	12.85
above Farm Bridge, . . . . .	12.85
between Farm Bridge and Bridle Point Bridge, . . .	12.71
Lower West Brook Meadows . . . . .	13.03
Upper West Brook Meadows . . . . .	14.40
Meadows below Bridle Point Bridge, . . . . .	12.31
about Station 4, . . . . .	12.50
south-west of Canal Bridge, . . . . .	12.82
south-west of the last mentioned, . . . . .	13.96
below Canal Bridge, . . . . .	12.12
about Station 6, . . . . .	12.28
about Station 7, . . . . .	12.05
above Sherman's Bridge, . . . . .	12.23
between Sherman's Bridge and Station 9, . . . . .	12.34
Lower Gulf Meadows, . . . . .	12.87
Upper Gulf Meadows, . . . . .	14.60
Meadows below the mouth of Gulf Brook, . . . . .	12.52
above Lee's Bridge, . . . . .	12.11
between Lee's Bridge and Fairhaven Bay, . . . . .	12.35
below Fairhaven Bay, . . . . .	12.36
above Nine Acre Corner Bridge, . . . . .	12.60
below Nine Acre Corner Bridge, . . . . .	12.70
about Station 13, . . . . .	13.15
between Stations 14 and 15, . . . . .	12.85
between Stations 15 and 17, . . . . .	12.73
near the mouth of Assabet, . . . . .	12.76

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TABLE—Continued.

Meadows between Barrett's Bridge and North Bridge, . . .	12.47
between North Bridge and Barrett's Bar, . . .	12.58
between Barrett's Bar and Station 24, . . .	11.54
between Station 24 and Carlisle Bridge, . . .	11.27
between Carlisle Bridge and Hill's Bridge, . . .	11.68
between Hill's Bridge and the Old Turnpike, . . .	12.11
above Middle Bridge, . . .	11.14
below Middle Bridge, . . .	11.97
at Billerica Corner, east side, . . .	13.33
at Billerica Corner, west side, . . .	11.59
below Corner Bridge, . . .	12.81

## [G.]

## TABLE OF DISTANCES.

NAME OF OBJECT.	Distance apart.	Distance between Stations.	DISTANCE FROM THE DAM.	
			Feet.	Miles.
Billerica Dam, . . . . .	—	—	—	—
Station 30, . . . . .	150	—	150	0.0284
“ 29, . . . . .	1,090	1,090	1,240	0.2348
Fordway Bar, . . . . .	1,800	—	3,040	0.5758
Station 28, . . . . .	600	2,400	3,640	0.6894
Pollard's Bar, . . . . .	1,520	—	5,160	0.9773
Corner Bridge, . . . . .	2,100	—	7,260	1.3750
Station 27, . . . . .	420	4,040	7,680	1.4545
Middle Bridge, . . . . .	6,300	—	13,980	2.6477
The Old Turnpike, . . . . .	2,340	—	16,320	3.0909
Hill's Bridge, . . . . .	7,560	—	23,880	4.5227
Station 26, . . . . .	7,570	23,770	31,450	5.9564
Carlisle Bridge, . . . . .	3,180	—	34,630	6.5587
Station 25, . . . . .	5,260	8,440	39,890	7.5549
“ 24, . . . . .	3,740	3,740	43,630	8.2633
“ 23, . . . . .	4,110	4,110	47,740	9.0417
Section, . . . . .	500	—	48,240	9.1364
Station 22, . . . . .	4,300	4,800	52,540	9.9508
Barrett's Bar, . . . . .	650	—	53,190	10.0739
Station 21, . . . . .	740	1,390	53,930	10.2140
North Bridge, . . . . .	2,530	—	56,460	10.6932
Station 20, . . . . .	1,190	3,720	57,650	10.9186
Section, . . . . .	320	—	57,970	10.9792
Station 19, . . . . .	1,050	1,370	59,020	11.1780
Barrett's Bridge, . . . . .	350	—	59,370	11.2443
Assabet Bar, . . . . .	800	—	60,170	11.3958
Station 17, . . . . .	540	1,690	60,710	11.4981
“ 16, . . . . .	2,400	2,400	63,110	11.9526
Turnpike Bridge, . . . . .	1,510	—	64,620	12.2386
Station 15, . . . . .	350	1,860	64,970	12.3049
South Bridge, . . . . .	200	—	65,170	12.3428
Railroad Bridge, . . . . .	80	—	65,250	12.3580
Section, . . . . .	2,000	—	67,250	12.7367
Station 14, . . . . .	680	2,960	67,930	12.8655
Section, . . . . .	1,020	—	68,950	13.0587
Station 13, . . . . .	950	1,970	69,900	13.2386
Nine-Acre Corner Bridge, . . . . .	3,300	—	73,200	13.8636
Fairhaven Bay, . . . . .	8,830	—	82,030	15.5360
Lee's Bridge, . . . . .	3,200	—	85,230	16.1420
Station 12, . . . . .	340	15,670	85,570	16.2064
“ 11, . . . . .	4,520	4,520	90,090	17.0625
Robbins's Bar, . . . . .	830	—	90,920	17.2197
Gulf Brook, . . . . .	1,170	—	92,090	17.4413
Station 10, . . . . .	160	2,160	92,250	17.4716
“ 9, . . . . .	1,400	1,400	93,650	17.7367



TABLE OF DISTANCES—Continued.

NAME OF OBJECT.	Distance apart.	Distance between Stations.	DISTANCE FROM THE DAM.	
			Feet.	Miles.
Section, . . . . .	2,000	—	95,650	18.1155
Station 8, . . . . .	1,960	3,960	97,610	18.4867
Sherman's Bridge, . . . . .	790	—	98,400	18.6364
Section, . . . . .	410	—	98,810	18.7141
Station 7, . . . . .	5,270	6,470	104,080	19.7121
Section, . . . . .	4,940	—	109,020	20.6477
Station 6, . . . . .	760	5,700	109,780	20.7917
“ 5, . . . . .	2,400	2,400	112,180	21.2462
Canal Bar, . . . . .	1,020	—	113,200	21.4394
Canal Bridge, . . . . .	150	—	113,350	21.4678
Station 4, . . . . .	1,820	2,990	115,170	21.8125
“ 3, . . . . .	3,520	3,520	118,690	22.4792
Bridle-Point Bridge, . . . . .	275	—	118,965	22.5313
Section, . . . . .	300	—	119,265	22.5881
Station 2, . . . . .	1,760	2,335	121,025	22.9214
Saddle Rock and Farm Bridge, . . . . .	320	—	121,345	22.9820
Section, . . . . .	8,560	—	129,905	24.6032
Station 1, . . . . .	3,040	11,920	132,945	25.1790
Stone Bound, . . . . .	1,260	—	134,205	25.4176
Station 34, . . . . .	15,740	17,000	149,945 <sup>+</sup>	28.3987 <sup>+</sup>
Dam at Saxonville, . . . . .	3,810	—	153,755 <sup>+</sup>	29.1203 <sup>+</sup>
Station 19, . . . . .	—	—	59,020	11.1780
“ 18, . . . . .	1,420	1,420	60,440	11.4470
“ 31, . . . . .	14,100	14,100	74,540	14.1174
“ 32, . . . . .	1,200	1,200	75,740	14.3447
Station 31, . . . . .	—	—	74,540	14.1174
“ 33, . . . . .	8,280	8,280	82,820	15.6856
Pole in Damon's Pond, . . . . .	1,320	1,320	84,140	15.9356

[H.]

Table of the Rain-fall as recorded by Observers on the Concord and Sudbury Rivers.

[The measurements are in inches and hundredths and show the vertical depth of water which fell in single storms.]

Stations, . . . . .	1.	5.	13.	26.	27.
1861.					
July 29, . . . .	Rain.	Rain.	0.38	0.42	Rain.
August 1, . . . .	1.13	0.90+	0.67	0.67	1.45
5, . . . .	—	Light rain.	Light rain.	Light rain.	.01
6, . . . .	—	“	“	0.13	Light rain.
7 and 8, . . . .	0.27	0.30	0.42	0.38	0.31
10, . . . .	0.13	0.19	0.11	Light rain.	Light rain.
13 and 14, . . . .	3.10	3.09	2.94	Not recorded.	2.97
22 and 23, . . . .	0.73	0.77	0.74	0.50	0.48
30, . . . .	Light rain.	0.05	—	Light, very.	Light, very.
	5.36+	5.30+	4.88+	4.65+	5.22+
September 11, . . . .	1.50	1.42	1.52	1.40	1.45
Stations, . . . . .	3.	11.	19.	21.	30.
September 22, . . . .	0.53	0.60	0.45	0.40+	0.50
28, . . . .	0.35	0.35	0.23	0.70	0.15
	2.38	2.37	2.20	2.50+	2.10
October 5, . . . .	At Station	4,	0.20	—	—
8, . . . .	“	11,	0.25	—	—
11, . . . .	“	11,	0.30	—	—

*Rain-fall at Lake Cochituate—Recorded by* EDWARD F. KNOWLTON.

[Furnished in anticipation of the Annual Report of JAMES SLADE, Esq., Engineer of the  
Boston Water Works.]

DATE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1, . . . . .	—	.20	—	—	.17	—	—	1.12	—	—	—	—
2, . . . . .	—	—	—	—	—	—	.32	—	—	—	—	—
3, . . . . .	—	—	—	.72	—	.68	—	—	—	—	3.06	.17
4, . . . . .	.82	—	.07	—	—	—	—	.17	—	.30	—	—
6, . . . . .	—	—	—	—	—	1.92	—	—	—	.35	—	—
7, . . . . .	—	.07	—	—	2.15	—	—	.30	—	—	—	—
8, . . . . .	—	—	—	—	.07	.02	—	—	—	—	—	—
9, . . . . .	—	—	—	—	—	—	.30	.24	—	.36	—	—
10, . . . . .	—	—	1.28	—	—	—	—	—	—	—	.62	—
11, . . . . .	—	—	.02	—	—	—	—	—	—	.52	.28	—
12, . . . . .	—	2.15	—	—	—	—	—	—	1.96	—	—	—
13, . . . . .	.17	—	—	1.67	—	—	—	3.60	—	—	—	—
14, . . . . .	—	—	.08	—	.30	—	.12	1.64	—	—	—	—
15, . . . . .	.52	.94	—	—	—	—	—	—	—	—	—	—
16, . . . . .	1.44	—	.14	2.79	—	—	—	—	—	—	—	—
17, . . . . .	—	—	—	1.26	—	—	.32	—	—	—	—	—
18, . . . . .	—	—	—	—	—	—	—	—	—	0.28	—	—
19, . . . . .	—	—	0.21	—	—	—	.56	—	—	—	—	—
20, . . . . .	—	—	—	—	—	—	—	—	—	0.76	—	—
21, . . . . .	—	0.17	—	—	0.07	0.02	—	—	—	—	—	—
22, . . . . .	—	—	0.45	—	—	—	—	0.72	—	0.40	—	—
23, . . . . .	—	—	—	—	—	—	—	—	0.74	—	—	—
24, . . . . .	0.48	—	—	—	—	—	—	—	—	—	0.72	—
25, . . . . .	—	—	—	—	—	—	—	—	—	—	0.08	—
27, . . . . .	—	—	0.50	—	—	—	—	—	—	.23	—	—
28, . . . . .	0.08	0.28	—	—	—	—	—	—	—	—	—	—
29, . . . . .	—	—	—	—	—	—	—	—	0.06	—	—	—
30, . . . . .	—	—	—	—	—	—	—	—	—	—	1.44	—
31, . . . . .	—	—	—	—	.36	—	—	—	—	—	—	—

*Rain-fall at the Guard Gates, Lowell.*

[Kept by the Proprietors of the Locks and Canals on Middlesex River. Furnished by JAMES B. FRANCIS, Esq.]

1861, . . . . .	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1, . . . . .	—	—	—	—	—	—	—	0.785	—	0.026	—	—
2, . . . . .	—	0.468	—	1.038	—	—	0.262	—	—	—	—	—
3, . . . . .	—	—	—	0.176	—	—	—	—	—	—	—	—
4, . . . . .	0.805	—	—	—	—	0.491	—	—	—	—	2.005	—
5, . . . . .	—	—	—	—	—	—	—	—	—	—	—	—
6, . . . . .	—	—	—	—	—	—	—	—	—	—	—	—
7, . . . . .	—	—	—	—	1.805	1.176	—	—	—	0.941	—	—
8, . . . . .	0.187	—	—	—	—	—	—	0.479	—	—	—	—
9, . . . . .	—	—	—	—	0.021	—	—	—	—	—	—	—
10, . . . . .	—	—	1.363	—	—	—	0.134	0.081	—	0.283	—	—
11, . . . . .	—	—	—	—	—	—	—	—	—	—	0.346	—
12, . . . . .	—	0.550	—	—	—	0.117	—	—	1.352	0.478	0.318	1.130
13, . . . . .	—	—	—	—	—	—	—	—	—	—	—	—
14, . . . . .	—	—	—	0.867	0.568	—	—	3.039	—	—	—	—
15, . . . . .	1.000	—	0.605	—	—	—	0.276	—	—	—	—	—
16, . . . . .	—	0.875	0.879	—	—	—	—	—	—	—	—	—
17, . . . . .	1,656	0.300	—	1,679	—	—	0.805	—	—	—	—	—

18,	.	.	.	.	—	—	—	—	—	—	—	—	—	—	—	—	—
19,	.	.	.	.	0.321	—	—	—	—	—	—	0.637	—	—	—	—	—
20,	.	.	.	.	—	—	0.263	—	—	0.159	0.761	—	—	0.695	—	—	—
21,	.	.	.	.	—	0.338	—	—	—	—	—	—	—	—	—	—	—
22,	.	.	.	.	—	—	1,217	—	—	—	—	—	—	—	—	—	—
23,	.	.	.	.	—	—	—	—	—	—	—	0.384	0.505	0.583	—	—	—
24,	.	.	.	.	—	—	—	—	—	—	—	—	—	—	0.692	—	—
25,	.	.	.	.	0.941	—	—	0.174	0.211	—	—	—	—	—	—	—	—
26,	.	.	.	.	—	—	—	—	0.253	—	—	—	—	—	0.200	—	—
27,	.	.	.	.	0.110	—	—	—	0.435	—	—	—	—	0.148	—	—	—
28,	.	.	.	.	—	—	0.242	—	0.694	—	0.098	—	0.182	—	0.059	—	—
29,	.	.	.	.	—	—	—	0.454	0.076	—	0.479	—	—	—	—	—	—
30,	.	.	.	.	0.133	—	—	—	—	—	0.272	—	—	—	—	—	—
Totals,	.	.	.	.	5.153	2.531	4.569	4.388	4.063	1.943	3.087	4.768	2.039	3.791	3.620	—	—

*Rain-fall at Waltham.*

[By Dr. EBENEZER HOBBS.]

1861, . . . . .	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1, . . . . .	—	—	—	—	—	—	—	0.76	—	—	—	—
2, . . . . .	—	1.12	—	1.10	—	—	0.24	—	—	—	1.56	—
3, . . . . .	—	—	—	—	—	0.63	—	—	—	—	—	—
4, . . . . .	—	—	—	—	—	—	—	—	—	—	—	—
5, . . . . .	—	—	—	—	—	—	—	—	—	—	—	—
6, . . . . .	—	—	—	—	1.28	—	—	—	—	0.28	—	—
7, . . . . .	—	—	—	—	—	1.32	—	—	—	—	—	—
8, . . . . .	—	—	—	—	—	—	—	0.35	—	0.18	—	—
9, . . . . .	—	—	1.05	—	—	—	—	0.36	—	—	—	—
10, . . . . .	—	—	—	—	—	—	0.32	—	—	—	—	—
11, . . . . .	—	—	—	—	—	0.06	—	—	1.50	0.19	—	—
12, . . . . .	—	0.77	—	—	—	—	—	} 2.87	—	—	—	—
13, . . . . .	—	—	0.10	—	—	—	—		—	—	—	—
14, . . . . .	2.56	—	—	—	—	—	0.10	0.09	—	—	—	—
15, . . . . .	—	0.78	—	—	0.50	—	—	—	—	—	—	—
16, . . . . .	—	—	—	} 3.00	—	—	0.40	—	—	—	—	—
17, . . . . .	—	0.32	—		—	—	—	—	—	—	—	—

APPENDIX.

[Jan.]

18,	.	.	.	.	—	—	—	—	—	—	—	—	—	—	—	—
19,	.	.	.	.	—	0.25	—	—	0.12	—	—	—	—	—	—	—
20,	.	.	.	.	—	—	—	—	—	1.00	—	—	—	0.92	—	—
21,	.	.	.	.	—	—	0.40	—	0.07	—	—	—	—	—	—	—
22,	.	.	.	.	—	—	—	—	—	—	0.70	0.48	—	—	—	—
23,	.	.	.	.	—	—	—	—	—	—	—	—	—	—	—	—
24,	.	.	.	.	—	—	—	—	—	—	—	—	—	0.14	—	—
25,	.	.	.	.	—	—	—	—	0.10	—	—	—	—	—	—	—
26,	.	.	.	.	—	—	—	—	—	—	—	—	—	—	—	—
27,	.	.	.	.	—	—	1.52	—	0.50	—	—	—	—	0.20	—	—
28,	.	.	.	.	—	—	—	0.50	—	—	—	0.16	—	—	—	—
29,	.	.	.	.	—	—	—	—	—	0.77	—	—	—	—	—	—
30,	.	.	.	.	—	—	—	—	0.16	—	—	—	—	—	—	—
Totals,	.	.	.	.	2.56	3.24	3.07	4.60	2.54	2.20	2.83	5.13	2.14	1.91	—	—

Rain-fall in Boston.  
[By J. P. HALL, Esq.]

1861, . . . . .	July.	August.	September.	October.	November.
1, . . . . .	} 0.30	0.73	-	0.05	-
2, . . . . .		-	-	-	} 1.60
3, . . . . .	-	0.05	-	-	
4, . . . . .	-	-	-	-	-
5, . . . . .	-	0.03	-	0.50	-
6, . . . . .	-	-	-	-	-
7, . . . . .	-	} 0.60	-	} 0.35	-
8, . . . . .	} 0.17		-		-
9, . . . . .		-	-	-	-
10, . . . . .	-	-	-	-	-
11, . . . . .	-	-	1.15	} 0.33	-
12, . . . . .	-	} 3.70	-		-
13, . . . . .	-		-	-	0.03
14, . . . . .	0.15	-	-	-	-
15, . . . . .	-	-	-	-	-
16, . . . . .	} 0.55	-	-	-	-
17, . . . . .		-	-	} 0.40	-
18, . . . . .	-	-	-		-
19, . . . . .	-	-	-	0.60	-
20, . . . . .	0.50	-	-	-	-
21, . . . . .	-	-	-	-	-
22, . . . . .	-	0.90	0.40	-	-
23, . . . . .	-	-	-	0.15	-
24, . . . . .	-	-	-	-	-
25, . . . . .	-	-	-	0.25	-
26, . . . . .	-	-	-	-	-
27, . . . . .	} 0.27	-	0.22	-	-
28, . . . . .		-	-	-	-
29, . . . . .	0.45	-	-	-	-
30, . . . . .	-	0.03	-	-	-
31, . . . . .	0.37	-	-	-	-
Totals, . . . . .	2.76	6.04	1.77	2.66	1.60



*Monthly Fall of Rain at Lake Cochituate.*

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Year.
1852, . .	5.80	1.76	4.42	9.60	2.60	2.00	2.16	8.27	2.04	3.40	2.76	3.12	16.62	12.43	8.20	47.93
1853, . .	3.68	6.56	2.92	3.80	6.32	0.56	2.84	7.20	5.44	4.56	5.26	6.59	13.04	10.60	15.26	55.73
1854, . .	2.45	5.16	4.16	5.60	3.92	2.08	2.32	0.28	3.68	3.37	7.79	2.34	13.68	4.68	14.84	43.15
1855, . .	4.52	3.50	1.91	2.65	0.82	1.98	3.86	0.77	0.75	4.16	4.84	5.20	5.38	6.61	9.75	34.96
1856, . .	1.44	0.22	0.66	4.27	7.81	1.77	1.76	11.40	3.13	2.34	1.43	4.57	12.74	14.93	6.90	40.80
1857, . .	2.51	1.30	1.72	10.23	7.15	4.02	8.85	6.62	4.27	7.06	3.07	6.30	19.10	19.49	14.40	63.10
1858, . .	2.61	3.32	3.87	4.39	2.23	10.17	3.46	6.42	5.17	2.12	2.91	1.99	10.49	20.05	10.20	48.66
1859, . .	5.64	2.91	10.95	1.37	3.46	3.16	0.99	7.69	4.56	0.33	3.55	4.41	15.78	11.84	8.44	49.02
1860, . .	1.24	3.80	1.98	2.25	1.98	11.16	6.82	4.89	9.92	1.72	5.97	3.71	6.21	22.87	17.61	55.44
1861, . .	3.51	3.81	2.75	6.44	3.12	2.64	1.62	7.79	2.76	3.20	6.20	—	12.31	12.05	12.16	—
Average, .	3.340	3.234	3.534	5.060	3.941	3.954	3.468	6.133	4.172	3.226	4.378	4.248				

*Monthly Fall of Rain at Lowell.*

[1852 to 1860—by Merrimack Manufacturing Company. 1861—by Locks and Canals Company.]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Year.
1852,. . .	1.44	2.96	3.06	8.86	1.22	3.33	2.31	8.07	1.64	2.14	4.78	2.97	13.14	13.71	8.56	42.78
1853,. . .	1.52	6.06	2.05	3.45	5.40	0.60	2.36	8.37	4.32	4.30	3.79	1.70	10.90	11.33	12.41	43.92
1854,. . .	2.36	3.53	3.34	4.86	4.31	3.49	2.12	0.18	4.67	4.28	6.28	2.84	12.33	5.79	15.23	42.08
1855,. . .	7.81	4.48	1.12	5.04	1.07	3.81	3.99	2.32	0.63	5.78	3.90	4.94	7.23	10.12	10.31	44.89
1856,. . .	2.83	1.07	0.90	3.48	5.31	2.09	1.73	12.31	4.79	2.03	2.53	3.42	9.69	16.13	9.35	42.49
1857,. . .	3.86	1.63	2.58	8.02	3.58	3.16	5.67	5.68	2.29	5.52	2.26	5.13	14.18	14.57	10.07	49.38
1858,. . .	2.58	1.78	1.52	4.21	3.53	5.40	3.24	3.42	3.58	3.10	1.26	4.11	9.26	12.06	7.94	37.73
1859,. . .	5.62	2.86	6.24	2.76	3.80	5.83	1.58	3.98	3.80	2.32	3.25	5.47	12.80	11.39	9.37	47.51
1860,. . .	0.66	2.06	2.08	1.02	1.91	4.87	6.87	5.03	9.44	2.46	4.65	5.86	5.01	16.77	16.55	46.91
1861,. . .	5.153	2.531	4.569	4.388	4.063	1.943	3.087	4.768	2.039	3.791	3.620	—	13.02	9.798	9.450	—
Average,	3.383+	2.896+	2.746—	4.591—	3.419+	3.452+	3.296—	5.412+	3.720—	3.572+	3.632	4.049—	—	—	—	—

*Monthly Fall of Rain at Waltham.*

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Year.
1852,. .	1.83	2.27	4.04	7.70	1.68	3.26	2.11	7.69	2.08	2.10	4.15	3.33	13.42	13.06	8.33	42.24
1853,. .	2.18	5.36	2.33	3.34	6.29	0.95	2.72	7.78	4.50	2.30	5.43	1.86	11.96	11.45	12.23	45.04
1854,. .	1.82	4.25	2.80	4.88	4.03	1.87	2.16	0.57	4.36	3.68	6.62	4.25	11.71	4.60	14.66	41.29
1855,. .	6.44	3.56	0.86	4.34	0.93	3.58	5.40	2.08	0.79	4.48	4.12	4.05	6.13	11.06	9.39	40.63
1856,. .	1.30		0.63	3.33	5.17	1.59	4.27	13.97	4.79	2.23	3.09	1.96	9.13	19.83	10.11	42.33
1857,. .	2.68	1.40	2.03	7.78	4.56	1.88	6.99	4.77	2.20	4.60	2.04	3.11	14.37	13.64	8.84	44.04
1858,. .	2.00	1.53	0.86	4.10	3.22	6.42	4.02	4.02	3.86	2.21	2.08	3.08	8.18	14.46	8.15	37.40
1859,. .	5.89	2.83	7.36	2.32	3.84	5.03	1.59	5.64	3.96	2.80	3.05	4.18	13.52	12.26	9.81	48.49
1861,. .	2.56	3.24	3.07	4.60	2.54	2.20	2.83	5.13	2.14	1.91	—	—	10.21	10.16	—	—
Average,	3.175	3.055	2.665—	4.710	3.585—	2.976—	3.566—	5.739—	3.187—	2.923+	3.822+	3.227+	—	—	—	—

1862.]

HOUSE—No. 1.

*Monthly Fall of Rain at Boston.*

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Year.
1852, . . . .	4.85	2.85	4.45	10.18	1.95	2.35	3.28	7.63	1.65	2.19	3.47	3.09	16.58	13.26	7.31	47.94
1853, . . . .	2.44	5.30	2.27	3.78	5.63	0.30	3.64	9.40	3.80	3.92	4.43	3.95	11.68	13.34	12.15	48.86
1854, . . . .	2.91	4.87	2.84	6.63	4.33	2.47	3.70	0.58	3.86	2.08	6.80	4.64	13.80	6.75	12.74	45.71
1855, . . . .	7.22	4.67	1.18	4.28	1.20	3.09	4.15	1.46	1.13	4.61	5.27	5.93	6.66	8.70	11.01	44.19
1856, . . . .	5.32	0.80	1.33	4.37	7.10	2.90	4.02	11.11	4.90	2.70	3.33	4.28	12.80	18.03	10.93	52.16
1857, . . . .	5.36	2.45	3.09	10.83	5.57	2.02	5.53	7.18	2.56	4.50	2.52	5.26	19.49	14.73	9.58	56.87
1858, . . . .	3.28	2.30	2.18	5.18	3.89	8.09	4.56	7.03	5.02	3.03	3.38	4.73	11.25	19.68	11.43	52.67
1859, . . . .	5.93	4.05	7.64	3.36	3.63	7.89	1.58	4.72	4.40	3.28	3.75	6.47	14.63	14.19	11.43	56.70
1860, . . . .	1.89	3.85	2.19	1.73	2.35	8.01	5.90	4.30	7.35	2.66	5.37	5.86	6.27	18.21	15.38	51.46
1861, . . . .	6.04	3.57	7.48	5.89	2.97	3.64	2.76	6.04	1.77	2.66	—	—	16.54	12.44	—	—
Average, . . . .	4.524	3.471	3.465	5.623	3.862	4.076	3.912	5.945	3.644	3.163	—	—	—	—	—	—
Av'ge for 38 yrs.,	3.52	3.29	3.60	3.95	3.55	3.04	3.42	4.44	3.44	3.46	—	—	—	—	—	—



MEAN HEIGHTS FOR EACH DAY.—CONCORD AND SUDBURY RIVERS.

JULY 27TH—SEPTEMBER 16TH, 1861.

Stations,	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	
July 27, . . . . .	12.70	12.64	12.59	12.57	12.32	12.31	12.06	12.05	11.90	11.89	11.70	11.67	11.66	11.66	11.56	11.60	11.44	11.49	11.14	11.09	11.09	10.70	10.57	10.52	10.51	10.49	10.50	10.45	10.18	10.10	
28, . . . . .	12.61	12.62	12.58	12.56	12.31	12.31	12.04	12.04	11.88	11.87	11.67	11.64	11.64	11.62	11.52	11.56	11.36	11.40	11.08	11.02	11.02	10.66	10.54	10.50	10.48	10.49	10.53	10.49	10.28	10.28	
29, . . . . .	12.55	12.56	12.52	12.50	12.29	12.29	12.02	12.02	11.86	11.86	11.66	11.63	11.64	11.62	11.56	11.59	11.47	11.53	11.17	11.10	11.09	10.68	10.54	10.49	10.46	10.47	10.49	10.44	10.14	10.14	
30, . . . . .	12.61	12.60	12.56	12.54	12.29	12.29	12.06	12.06	11.94	11.93	11.79	11.77	11.76	11.76	11.72	11.74	11.67	11.72	11.36	11.29	11.28	10.86	10.72	10.64	10.63	10.62	10.63	10.56	10.22	10.22	
31, . . . . .	12.73	12.69	12.63	12.60	12.33	12.32	12.08	12.08	11.96	11.96	11.81	11.79	11.78	11.77	11.73	11.74	11.64	11.69	11.34	11.27	11.26	10.86	10.73	10.66	10.65	10.65	10.65	10.58	10.26	10.25	
Aug. 1, . . . . .	12.95	12.87	12.79	12.76	12.48	12.46	12.21	12.22	12.09	12.09	11.93	11.90	11.89	11.88	11.85	11.87	11.78	11.83	11.48	11.41	11.39	11.00	10.86	10.79	10.77	10.76	10.74	10.65	10.27	10.26	
2, . . . . .	12.95	12.93	12.86	12.84	12.54	12.53	12.26	12.27	12.14	12.13	11.95	11.93	11.92	11.90	11.86	11.87	11.73	11.77	11.43	11.37	11.35	10.98	10.84	10.78	10.77	10.77	10.76	10.68	10.29	10.29	
3, . . . . .	12.94	12.91	12.85	12.82	12.57	12.55	12.29	12.30	12.14	12.13	11.92	11.89	11.88	11.87	11.80	11.81	11.62	11.66	11.32	11.27	11.26	10.90	10.78	10.72	10.71	10.70	10.72	10.64	10.28	10.28	
4, . . . . .	12.84	12.86	12.82	12.79	12.56	12.55	12.27	12.28	12.11	12.08	11.84	11.82	11.80	11.78	11.72	11.72	11.50	11.53	11.22	11.18	11.15	10.80	10.68	10.64	10.63	10.63	10.66	10.60	10.33	10.33	
5, . . . . .	12.74	12.76	12.72	12.69	12.51	12.51	12.22	12.23	12.03	12.02	11.76	11.73	11.71	11.69	11.64	11.63	11.42	11.45	11.12	11.06	11.06	10.69	10.58	10.52	10.52	10.51	10.54	10.47	10.16	10.16	
6, . . . . .	12.83	12.78	12.72	12.68	12.47	12.45	12.17	12.17	11.99	11.98	11.72	11.69	11.67	11.65	11.60	11.59	11.39	11.41	11.08	11.03	11.01	10.64	10.54	10.49	10.47	10.47	10.48	10.42	10.10	10.10	
7, from 5 a. m. to 6 p. m.,	12.85	12.78	12.71	12.68	12.45	12.44	12.14	12.14	11.97	11.96	11.73	11.70	11.69	11.67	11.62	11.61	11.43	11.45	11.12	11.07	11.06	10.69	10.57	10.52	10.51	10.51	10.51	10.43	10.09	10.10	
Aug. 8, . . . . .	12.87	12.80	12.74	12.71	12.48	12.45	12.14	12.14	11.96	11.94	11.67	11.64	11.62	11.59	11.52	11.50	11.24	11.25	10.90	10.83	10.82	10.37	10.23	10.17	10.16	10.15	10.13	10.00	8.71	8.71	
9, . . . . .	12.86	12.81	12.75	12.72	12.48	12.47	12.12	12.12	11.92	11.90	11.61	11.58	11.56	11.53	11.47	11.45	11.20	11.22	10.84	10.76	10.75	10.24	10.10	10.02	10.00	10.00	9.88	8.68	8.68		
10, . . . . .	12.90	12.85	12.78	12.76	12.50	12.49	12.10	12.11	11.90	11.87	11.57	11.54	11.52	11.49	11.43	11.41	11.15	11.16	10.78	10.70	10.70	10.16	10.03	9.95	9.93	9.93	9.93	9.82	8.63	8.64	
11, . . . . .	12.81	12.81	12.76	12.73	12.49	12.48	12.09	12.09	11.88	11.85	11.54	11.51	11.48	11.46	11.41	11.39	11.16	11.19	10.79	10.71	10.70	10.16	10.02	9.93	9.92	9.90	9.88	9.77	8.65	8.64	
Aug. 12, from 7 a. m. to 9 p. m.,	12.69	12.69	12.65	12.62	12.43	12.40	12.05	12.05	11.84	11.82	11.50	11.47	11.46	11.43	11.38	11.36	11.15	11.18	10.77	10.69	10.68	10.12	9.98	9.89	9.87	9.86	9.86	9.75	7.28	7.25	
13, . . . . .	13.08	12.92	12.85	12.81	12.51	12.49	12.21	12.22	12.01	11.98	11.67	11.68	11.66	11.61	11.57	11.55	11.34	11.36	10.96	10.87	10.82	10.37	10.20	10.09	10.06	10.05	9.99	9.87	7.33	7.29	
14, . . . . .	13.81	13.40	13.32	13.25	12.94	12.90	12.65	12.65	12.51	12.49	12.27	12.24	12.21	12.19	12.19	12.18	12.12	12.15	11.78	11.68	11.64	11.17	10.93	10.83	10.80	10.73	10.66	10.43	7.54	7.43	
15, . . . . .	14.16	13.78	13.69	13.62	13.29	13.26	13.00	12.99	12.84	12.82	12.61	12.58	12.56	12.56	12.59	12.57	12.55	12.90	12.22	12.11	12.05	11.60	11.31	11.19	11.18	11.16	11.05	10.82	7.82	7.68	
16, . . . . .	14.15	13.92	13.84	13.79	13.55	13.53	13.34	13.31	13.15	13.13	12.90	12.86	12.85	12.84	12.84	12.83	12.77	12.80	12.42	12.33	12.26	11.82	11.52	11.40	11.39	11.37	11.25	11.01	8.18	8.09	
17, . . . . .	14.07	13.93	13.87	13.83	13.64	13.63	13.47	13.43	13.27	13.24	12.97	12.92	12.89	12.84	12.78	12.76	12.56	12.56	12.23	12.16	12.10	11.72	11.49	11.40	11.39	11.37	11.25	11.06	8.16	8.03	
18, . . . . .	13.80	13.80	13.77	13.74	13.60	13.58	13.43	13.39	13.19	13.16	12.87	12.81	12.78	12.71	12.63	12.60	12.33	12.33	12.01	11.93	11.89	11.51	11.30	11.22	11.21	11.19	11.10	10.89	7.94	7.80	
19, . . . . .	13.87	13.71	13.67	13.63	13.48	13.46	13.28	13.25	13.02	12.99	12.69	12.64	12.59	12.53	12.44	12.42	12.13	12.13	11.80	11.73	11.69	11.30	11.10	11.01	11.00	10.98	10.89	10.67	7.62	7.47	
20, . . . . .	13.84	13.71	13.66	13.61	13.43	13.41	13.15	13.11	12.85	12.81	12.46	12.40	12.36	12.29	12.20	12.17	11.86	11.85	11.51	11.43	11.40	10.99	10.80	10.71	10.70	10.68	10.61	10.42	7.36	7.23	
21, . . . . .	13.64	13.62	13.58	13.54	13.36	13.34	13.02	12.98	12.70	12.67	12.31	12.25	12.22	12.15	12.06	12.03	11.71	11.70	11.35	11.27	11.24	10.80	10.60	10.51	10.50	10.50	10.47	10.29	7.37	7.27	
22, . . . . .	13.48	13.47	13.44	13.40	13.23	13.22	12.87	12.84	12.56	12.53	12.17	12.11	12.08	12.02	11.94	11.91	11.60	11.59	11.23	11.15	11.13	10.65	10.45	10.36	10.34	10.35	10.35	10.17	7.33	7.24	
23, . . . . .	13.56	13.47	13.42	13.38	13.19	13.17	12.82	12.79	12.53	12.50	12.16	12.10	12.06	12.00	11.93	11.90	11.63	11.63	11.27	11.18	11.16	10.71	10.50	10.40	10.39	10.38	10.31	10.13	7.34	7.26	
24, . . . . .	13.62	13.46	13.41	13.36	13.15	13.13	12.73	12.70	12.43	12.40	12.05	12.00	11.97	11.91	11.85	11.83	11.56	11.57	11.20	11.11	11.09	10.62	10.41	10.31	10.30	10.29	10.26	10.04	7.34	7.27	
25, . . . . .	13.39	13.38	13.34	13.31	13.11	13.09	12.67	12.65	12.39	12.36	12.02	11.97	11.94	11.89	11.83	11.81	11.56	11.56	11.20	11.11	11.09	10.62	10.42	10.32	10.31	10.30	10.26	10.04	7.33	7.26	
26, . . . . .	13.25	13.25	13.21	13.18	13.01	13.00	12.59	12.57	12.31	12.28	11.93	11.89	11.86	11.81	11.75	11.73	11.47	11.47	11.11	11.02	11.01	10.53	10.34	10.24	10.23	10.22	10.19	10.04	7.31	7.24	
27, . . . . .	13.21	13.18	13.14	13.10	12.92	12.91	12.47	12.45	12.18	12.15	11.78	11.74	11.73	11.67	11.61	11.58	11.30	11.31	10.93	10.85	10.84	10.34	10.16	10.07	10.06	10.07	10.07	9.92	7.31	7.25	
28, . . . . .	13.16	13.11	13.07	13.03	12.85	12.83	12.36	12.35	12.08	12.05	11.68	11.64	11.63	11.58	11.52	11.50	11.24	11.25	10.86	10.78	10.78	10.26	10.08	9.99	9.97	9.98	9.99	9.84	7.35	7.30	
29, . . . . .	13.21	13.09	13.04	12.99	12.79	12.77	12.28	12.28	12.02	11.99	11.62	11.58	11.57	11.52	11.47	11.45	11.21	11.23	10.85	10.76	10.75	10.23	10.05	9.96	9.94	9.94	9.95	9.89	7.30	7.26	
30, . . . . .	13.15	13.07	13.02	12.98	12.76	12.75	12.24	12.23	11.97	11.94	11.56	11.52	11.50	11.45	11.40	11.37	11.13	11.14	10.77	10.68	10.67	10.17	10.00	9.91	9.89	9.89	9.88	9.74	7.36	7.32	
31, . . . . .	13.09	13.01	12.96	12.92	12.71	12.69	12.21	12.19	11.93	11.90	11.52	11.48	11.44	11.40	11.35	11.32	11.09	11.10	10.72	10.64	10.63	10.12	9.96	9.88	9.86	9.85	9.83	9.69	7.26	7.23	
Sept. 1, . . . . .	12.95	12.95	12.90	12.86	12.67	12.65	12.15	12.14	11.88	11.84	11.44	11.41	11.37	11.32	11.25	11.23	10.92	10.91	10.56	10.49	10.49	10.00	9.87	9.80	9.78	9.78	9.65	7.26	7.23		
2, . . . . .	12.84	12.83	12.78	12.75	12.58	12.57	12.08	12.07	11.82	11.78	11.39	11.36	11.34	11.31	11.27	11.25	11.06	11.09	10.67	10.59	10.5										



[C.]

## EFFECT OF LOWERING AT THE DAM.

Stations, . . . . .	1.	2.	3.	4.	5.	6.	7.	8.	9.	ROBBIN'S BAR.		12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	Average.	Running over Dam.
										Gulf Brook.																						
1901.																																
August 7th, . . . . .	12.85	12.78	12.71	12.68	12.45	12.44	12.14	12.14	11.97	11.96	11.73	11.70	11.69	11.67	11.62	11.61	11.43	11.45	11.12	11.07	11.06	10.69	10.57	10.52	10.51	10.51	10.51	10.43	10.43	10.10	164 inches below.	
7th to 8th, Fall, . . . . .	-0.02	-0.02	-0.03	-0.03	-0.03	-0.01	0.00	0.00	0.01	0.02	0.06	0.06	0.07	0.08	0.10	0.11	0.19	0.20	0.22	0.24	0.32	0.34	0.35	0.35	0.36	0.35	0.43	1.33	1.39	"		
7th to 9th, " . . . . .	-0.01	-0.03	-0.04	-0.04	-0.03	-0.03	0.02	0.02	0.05	0.06	0.12	0.12	0.13	0.14	0.15	0.16	0.23	0.23	0.28	0.31	0.31	0.45	0.47	0.50	0.51	0.51	0.51	0.55	1.41	1.42		"
7th to 10th, " . . . . .	-0.05	-0.07	-0.07	-0.08	-0.05	-0.05	0.04	0.03	0.07	0.09	0.16	0.16	0.17	0.18	0.19	0.20	0.28	0.29	0.34	0.37	0.36	0.53	0.54	0.57	0.58	0.58	0.58	0.61	1.40	1.46		"
7th to 11th, " . . . . .	0.04	-0.03	-0.05	-0.05	-0.04	-0.04	0.05	0.05	0.09	0.11	0.19	0.19	0.21	0.21	0.22	0.27	0.26	0.33	0.36	0.36	0.53	0.55	0.59	0.59	0.61	0.63	0.66	1.41	1.46	"		
7th to 30th, " . . . . .	-0.30	-0.29	-0.31	-0.30	-0.31	-0.31	-0.10	-0.09	0.00	0.02	0.17	0.18	0.19	0.22	0.22	0.24	0.30	0.31	0.35	0.39	0.39	0.52	0.57	0.61	0.62	0.62	0.63	0.69	2.73	2.78		"
6th, . . . . .	12.88	12.78	12.73	12.68	12.47	12.45	12.17	12.17	11.96	11.98	11.73	11.69	11.67	11.65	11.60	11.59	11.39	11.41	11.08	11.03	11.01	10.64	10.54	10.49	10.47	10.47	10.48	10.42	10.10	10.10	Running over Dam.	
6th to 12th, Fall, . . . . .	0.14	0.00	0.07	0.06	0.04	0.05	0.12	0.12	0.15	0.16	0.22	0.22	0.21	0.22	0.22	0.23	0.24	0.33	0.31	0.34	0.33	0.52	0.56	0.60	0.60	0.61	0.62	0.67	2.92	2.85		"
6th to 31st, " . . . . .	-0.26	-0.23	-0.24	-0.24	-0.24	-0.24	-0.04	-0.02	0.06	0.08	0.20	0.21	0.23	0.25	0.25	0.27	0.30	0.31	0.36	0.39	0.38	0.52	0.58	0.61	0.61	0.62	0.65	0.73	2.84	2.87	"	

## EFFECT OF RAISING AT THE DAM.

1881.																																
September 1st,	12.95	12.95	12.90	12.86	12.67	12.65	12.15	12.14	11.88	11.84	11.44	11.41	11.37	11.32	11.25	11.23	10.92	10.91	10.56	10.49	10.49	10.00	9.87	9.80	9.78	9.78	9.78	9.65	7.29	7.23	Average.	} 33 inches below.
2d,	12.84	12.83	12.78	12.75	12.58	12.57	12.08	12.07	11.82	11.78	11.39	11.36	11.34	11.31	11.27	11.25	11.06	11.06	10.67	10.59	10.58	10.01	9.83	9.73	9.71	9.71	9.74	9.62	7.19	7.17	"	
8th,	12.85	12.76	12.69	12.65	12.44	12.42	11.91	11.81	11.64	11.61	11.17	11.14	11.12	11.07	11.00	10.97	10.69	10.68	10.34	10.28	10.28	9.76	9.62	9.55	9.55	9.57	9.46	7.33	7.33	"	5 & 6 a.m.	
1st to 15th, Rise,	-0.06	-0.06	-0.06	-0.06	-0.05	-0.05	0.02	0.02	0.01	0.01	-0.01	-0.01	0.01	0.03	0.06	0.06	0.21	0.22	0.27	0.29	0.30	0.47	0.49	0.52	0.53	0.53	0.60	0.68	2.95	2.98	Average.	
2d to 16th, "	-0.05	-0.05	-0.06	-0.05	-0.01	-0.03	0.06	0.07	0.06	0.06	0.05	0.04	0.04	0.04	0.05	0.04	0.12	0.10	0.22	0.25	0.26	0.51	0.57	0.64	0.64	0.63	0.62	0.65	2.88	2.88	"	} Running over Dam on 15th, 16th, and 11th.
8th to 11th, "	-0.36	-0.34	-0.32	-0.32	-0.27	-0.28	-0.16	-0.16	-0.09	-0.09	-0.01	0.00	0.00	0.02	0.03	0.03	0.09	0.10	0.18	0.20	0.19	0.44	0.47	0.51	0.51	0.51	0.56	0.63	2.87	2.89	"	

Lowering from Ordinary Condition to 13 1/2 inches.

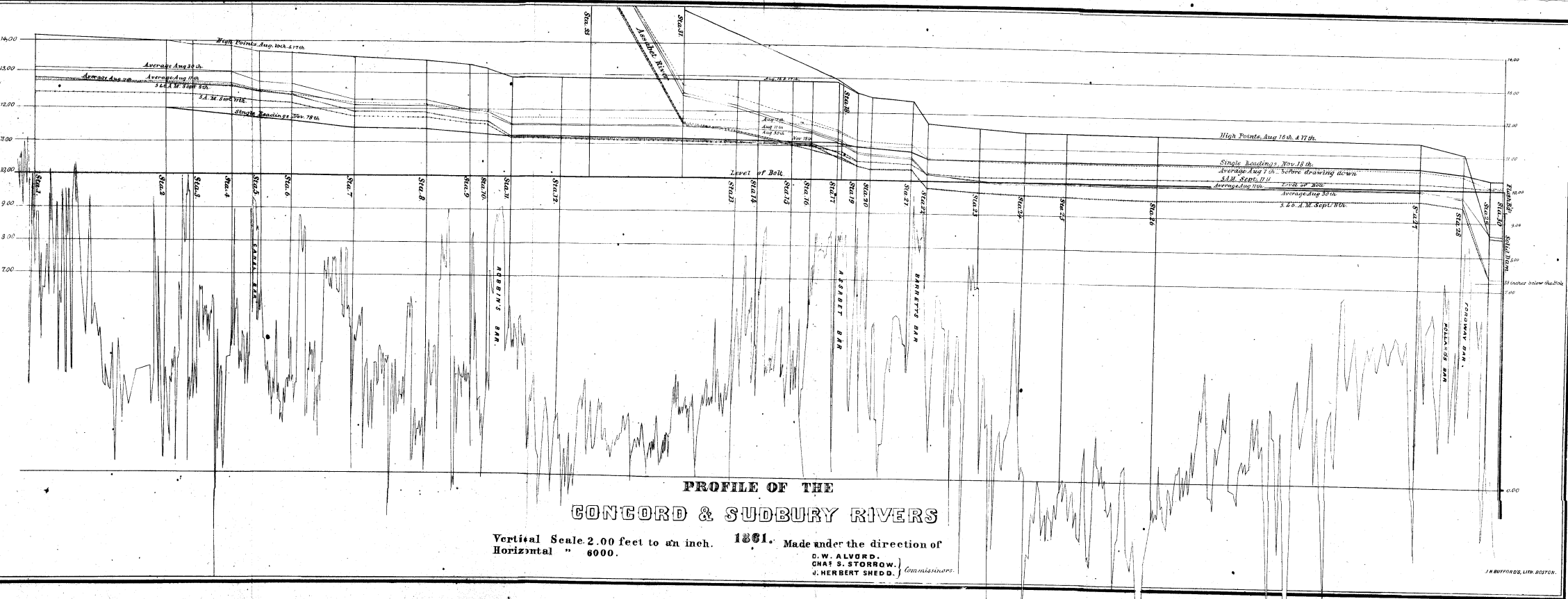
Stations, . . . . .	22.	23.	24.	25.	26.	27.	28.	29.	30.
August 7, 6 p. m., . . . . .	10.65	10.53	10.47	10.47	10.47	10.48	10.41	10.07	10.07
7 " . . . . .	10.65	10.53	10.48	10.47	10.46	10.46	10.34	9.46	9.47
8 " . . . . .	10.65	10.53	10.47	10.45	10.46	10.41	10.26	8.83	8.83
9 " . . . . .	10.64	10.53	10.45	10.44	10.45	10.38	10.23	8.75	8.75
August 8, 5 a. m., . . . . .	10.45	10.29	10.27	10.27	10.24	10.10	8.92	8.61	
12 m., . . . . .	10.37	10.24	10.16	10.15	10.14	10.12	9.99	8.68	8.67
6 p. m., . . . . .	10.34	10.20	10.12	10.11	10.10	10.08	9.96	8.72	8.71

Lowering from 16 1/2 inches to 33 inches below Ordinary Condition.

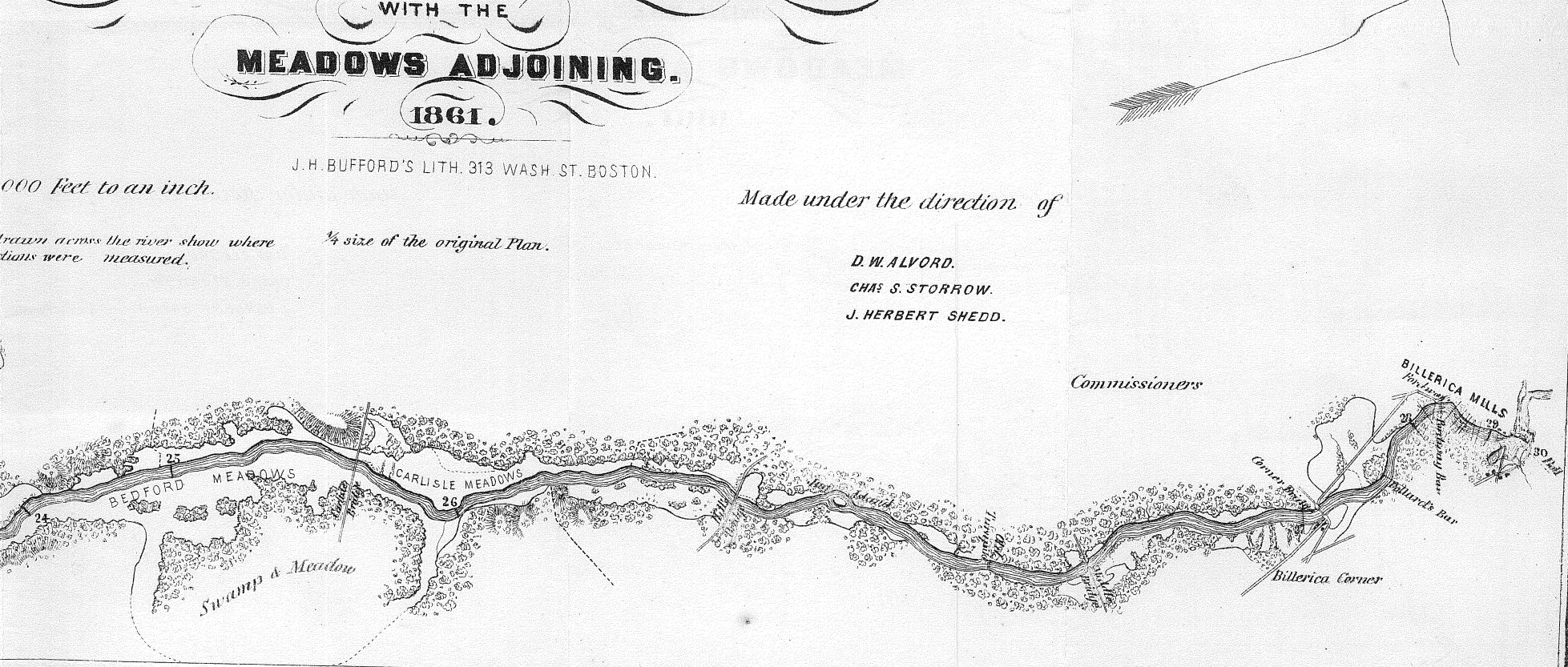
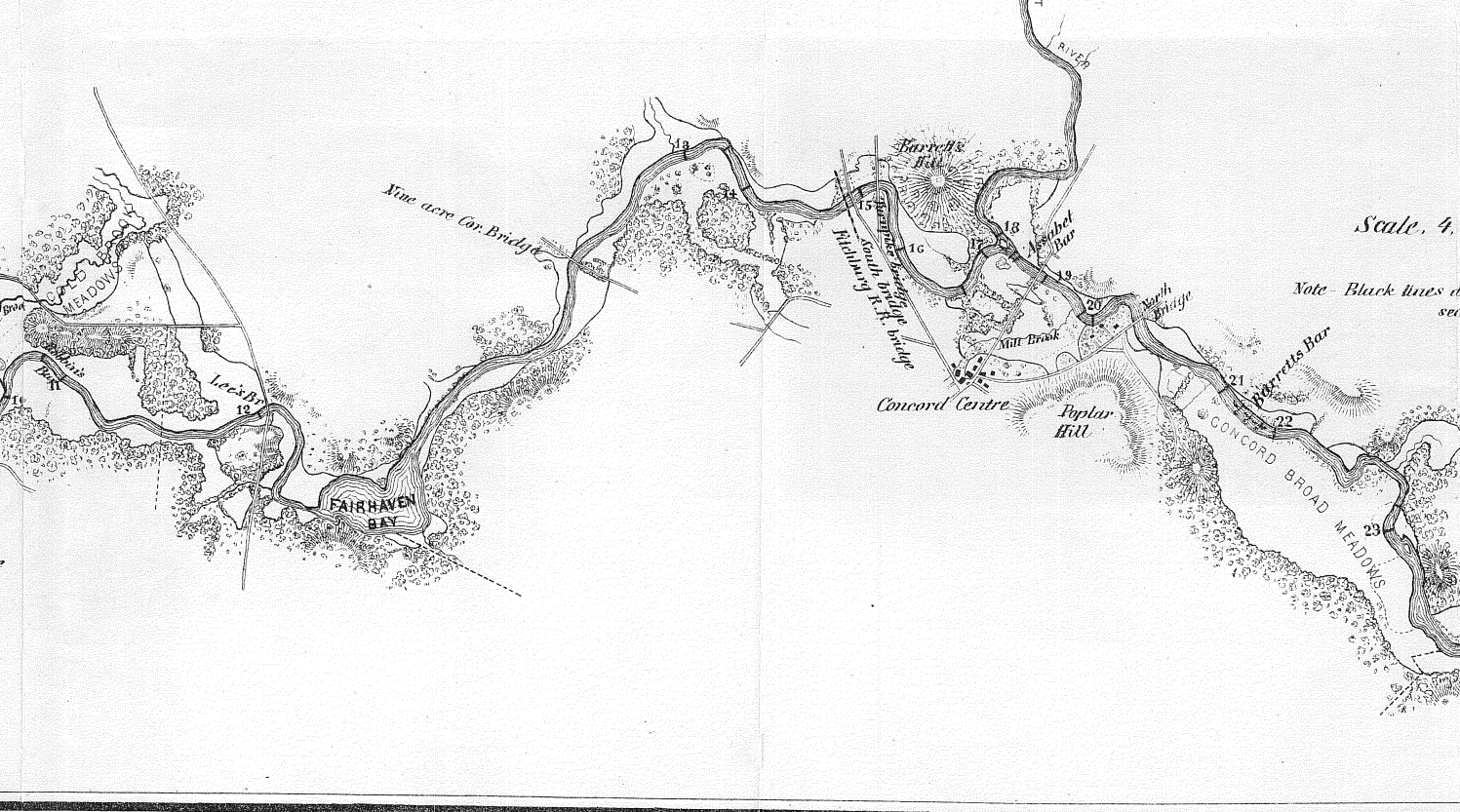
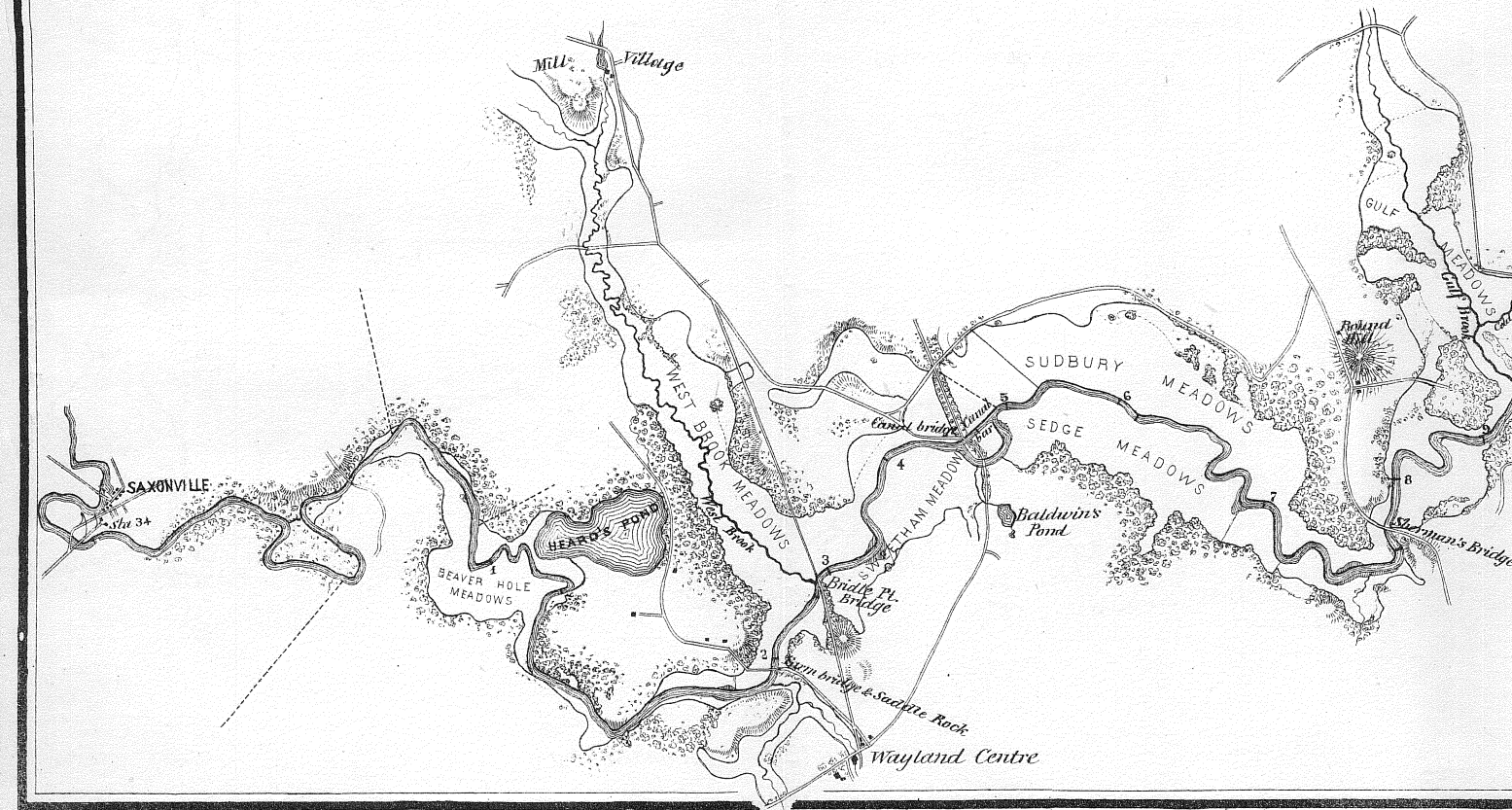
Stations, . . . . .	22.	23.	24.	25.	26.	27.	28.	29.	30.
August 11—Average, . . . . .	10.16	10.02	9.93	9.92	9.90	9.88	9.77	8.65	8.64
August 12, 5 a. m., . . . . .	10.10	9.97	9.89	9.87	9.87	9.87	9.77	8.58	8.57
6 " . . . . .	10.10	9.97	9.89	9.87	9.86	9.87	9.77	7.70	7.67
7 " . . . . .	10.08	9.96	9.89	9.87	9.86	9.87	9.76	7.25	7.22
8 " . . . . .	10.08	9.96	9.89	9.86	9.86	9.85	9.75	7.28	7.25
9 " . . . . .	10.08	9.96	9.89	9.86	9.86	9.85	9.74	7.30	7.28
10 " . . . . .	10.08	9.97	9.89	9.86	9.86	9.84	9.74	7.30	7.27
11 " . . . . .	10.09	9.96	9.88	9.86	9.85	9.85	9.75	7.28	7.25
12 " . . . . .	10.10	9.96	9.88	9.86	9.85	9.85	9.74	7.28	7.25
1 p. m., . . . . .	10.12	9.97	9.88	9.86	9.85	9.84	9.74	7.28	7.25
2 " . . . . .	10.14	9.98	9.89	9.86	9.86	9.84	9.74	7.28	7.25
3 " . . . . .	10.14	9.98	9.89	9.87	9.86	9.85	9.74	7.27	7.24
4 " . . . . .	10.14	9.99	9.90	9.87	9.86	9.85	9.74	7.27	7.25
5 " . . . . .	10.14	9.99	9.89	9.87	9.86	9.86	9.75	7.29	7.25
6 " . . . . .	10.14	9.99	9.89	9.87	9.86	9.86	9.76	7.30	7.26
7 " . . . . .	10.15	9.99	9.89	9.87	9.86	9.87	9.76	7.29	7.26
8 " . . . . .	10.15	10.00	9.89	9.87	9.86	9.87	9.76	7.29	7.26
9 " . . . . .	10.16	—	9.89	9.88	9.86	9.88	9.77	7.30	7.27
August 13, 5 a. m., . . . . .	10.13	—	9.93	9.91	9.91	9.89	9.78	7.38	7.35
6 " . . . . .	10.14	—	9.95	9.92	9.91	9.89	9.78	7.38	7.34
7 " . . . . .	10.14	—	10.02	9.94	9.92	9.90	9.78	7.37	7.34

Lowering from 33 inches to 57 inches below Ordinary Condition.

Stations,	22.	23.	24.	25.	26.	27.	28.	29.	30.
Sept. 4—Average,	9.99	9.83	9.75	9.73	9.73	9.73	9.59	7.30	7.26
Sept. 5, 1 p. m.,	9.95	9.77	9.70	9.68	9.68	9.70	9.58	—	7.26
2 "	9.96	9.77	9.70	9.68	9.69	9.70	9.58	6.13	5.97
3 "	9.97	9.79	9.70	9.68	9.69	9.70	9.58	5.67	5.46
4 "	9.97	9.79	9.70	9.69	9.69	9.72	9.59	5.58	5.34
5 "	9.98	9.80	9.71	9.69	9.69	9.71	9.59	5.55	5.29
6 "	9.99	9.80	9.71	9.70	9.69	9.70	9.58	5.53	5.28
7 "	10.00	9.80	9.72	9.70	9.69	9.71	9.58	5.53	5.27
8 "	10.01	9.80	9.72	9.70	9.69	9.71	9.58	5.53	5.27
9 "	10.01	9.81	9.72	—	—	9.72	9.59	5.54	5.28
Sept. 6, 5 a. m.,	9.91	9.77	9.71	9.69	9.70	9.72	9.59	5.54	5.28
6 "	9.90	9.77	9.70	9.69	9.69	9.71	9.58	5.54	5.28
7 "	9.90	9.76	9.70	9.68	9.68	9.70	9.58	5.52	5.28
8 "	9.89	9.76	9.69	9.67	9.68	9.70	9.57	5.51	5.25
9 "	9.87	9.74	9.68	9.67	9.67	9.69	9.57	5.51	5.25
10 "	9.87	9.72	9.67	9.66	9.67	9.69	9.57	5.50	5.24
11 "	9.87	9.72	9.66	9.65	9.65	9.69	9.57	5.51	5.25
12 "	9.88	9.72	9.64	9.64	9.65	9.70	9.58	5.51	5.25
1 p. m.,	9.89	9.72	9.63	9.63	9.65	9.71	9.58	5.52	5.25
2 "	9.91	9.73	9.63	9.62	9.64	9.71	9.58	5.53	5.26
3 "	9.92	9.74	9.64	9.62	9.64	9.70	9.58	5.52	5.26
4 "	9.93	9.74	9.64	9.63	9.65	9.69	9.57	5.52	5.25
5 "	9.92	9.75	9.65	9.64	9.66	9.69	9.58	5.51	5.25







Plan of  
**CONCORD & SUDBURY RIVERS,**  
WITH THE  
**MEADOWS ADJOINING.**  
1861.

J. H. BUFFORD'S LITH. 313 WASH. ST. BOSTON.

Scale, 4,000 Feet to an inch.

Note - Black lines drawn across the river show where sections were measured.

1/4 size of the original Plan.

Made under the direction of

D. W. WALVORD.  
CHAS. S. STORROW.  
J. HERBERT SHEDD.

Commissioners

